The Electrical World.

VOL. XXVI. NEW YORK, NOVEMBER 2, 1895. No. 18.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 927 Chestnut Street.

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THE ELECTRICAL WORLD,

253 Broadway, New York.

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ELECTRIC TRACTION IN NEW YORK CITY.

In a recent interview Mr. John D. Crimmins, president of the New York Metropolitan Traction Company, expressed the opinion that no more cable roads will be built if the Lenox Avenue conduit line successfully passes the ordeal of this Winter's storms. Of this, however, there can be little doubt, in view of the experience of almost six years at Budapest with practically the same system. No difficulty has been encountered there from this cause, notwithstanding the severe conditions sometimes present; on the contrary, one of the first tests to which this pioneer road was subjected early in its career was a blizzard, during which it remained in operation while horse traction was entirely suspended. Another extension of electric traction in New York City which has just been announced, is the equipment of the shuttle road from Third Avenue to the Long Island City ferry with storage battery cars, to be supplied by the Electric Storage Battery Company. These will be the first storage battery cars used on an elevated road, and as their trial will be coincident with that of a similar system on Madison Avenue, the coming months will be an important period in the history of storage battery traction.

TRANSFORMATION OF PHASES AND FREQUENCIES.

It will be remembered by those who heard or read Prof. Rowland's remarks made at the Washington meeting of the National Electric Light Association in the discussion of Mr. C. F. Scott's paper, that he announced his regret at not being then able to describe a method he was perfecting for the transformation, not alone of phases, but also of frequencies. In another column we print an outline of a patent recently granted to Prof. Rowland, from which an idea of the invention referred to may be obtained. As there illustrated it will be readily seen that by means of the devices shown a range of frequencies may be obtained from (zero or a continuous current) to the highest within the wide limits of the apparatus, and all these from an alternating current of any frequency or from a continuous current. Furthermore, by means of a phasing transformer the phases of such currents may be adjusted to suit any desired purpose, one of the uses pointed out being to start synchronous motors under load. While objections to the system may occur to some, such as relate to sparking at the commutator, and practical means for securing the necessary invariable rotary speed o the commutator or brushes with relation to the periodicity of one or the other circuit, these may well await the appearance of an apparatus in a practical form. The method, if commercially applicable, will be one of such great value that it is sincerely to be hoped that we may soon hear of its having been put in shape to be submitted to test in actual industrial work.

THE INSTITUTE PAPERS.

The character of the papers read at the October meeting of the American Institute of Electrical Engineers will please those who favor papers having a decided practical bearing, and at the same time will be satisfactory to the others who consider that even highly scientific and mathematical contributions announcing the result of original research, are in harmony with the objects of the Institute. It happened, rather singularly, that the attendance at the New York meeting was considerably below the average, notwithstanding the value and interest of the practical subjects treated. While this has no significance, being doubtless due to mere chance, it will, nevertheless, be likely to lead those who condemn the other class of papers to be somewhat more guarded as to statements

concerning the relative interest to members in general of different subjects or methods of treatment. The paper of Mr. Lemp, an abstract of which is printed elsewhere in this issue, describes one of the most interesting applications thus far made of electric heating. The problem relating to piercing holes in armor for fastening bolts and to cutting openings in gun shields, was a difficult one with a material tempered to a depth of a quarter of an inch. If the openings and holes were cut before the armor was treated there were complications in applying the tempering process and risk of cracks in the plate, while the extreme hardness of the temper rendered the metal unworkable by tools. By means of the electric annealing process, all difficulties in working Harveyized and other treated armor plates have been removed, and in a manner so simple and neat as to compel admiration from all. It is interesting to note the immense current applied—10,000 amperes or 40,000 amperes per square inch of surface—and the beautiful manner in which, by means of cyclic E. M. Fs., the working current is obtained almost at the tool itself, by transformation from a voltage that keeps the dimensions of the generating apparatus and conducting leads to proportions not dependent upon the enormous current required for the operation. Another interesting feature is the application of the tuyere principle of water circulation to the contact tool, thus enabling it to be of a size to suit the requirements of work and largely independent of sectional area and contact surface. The paper of Prof. Stine, which is, perhaps, the most practical contribution yet made to the subject of safety fuses, is reserved for another issue.

CENTRAL AND POWER STATION EXHAUST STEAM FOR HEATING.

The consolidation foreshadowed some time ago in our columns of certain electric lighting interests in Philadelphia has taken place, and the official announcement of this fact also makes known that one of the important functions of the new concern will be the distribution of exhaust steam for heating purposes. It is intimated that besides disposing in this manner of the exhaust steam of the consolidated companies, arrangements may be made for that purpose with one or more of the electric traction power houses. This news is welcome, as it needs but an extensive demonstration, such as is thus promised in Philadelphia, to bring the subject actively before all companies generating electrical current. While the distribution of exhaust steam has been much discussed, it has not received the application which the promise contained might seem to warrant. In general, however, there has been an absence of direct practical knowledge relating to the working of the method under the varied conditions which apply in electrical generating work, and therefore the hesitancy in taking it up is excusable. While there is no doubt of the profit to be derived from the sale of exhaust steam, provided the entire output can be sold, it is apparent to any one that at times when the demand is small the returns may easily be less than the cost of the steam necessarily used, directly or indirectly, in maintaining the distribution. The problem of distributing exhaust steam at a resultant profit is, therefore, not one having an obvious solution, and this fact has deterred many from undertaking it. The best solution is, indeed, an involved one, and implies the need of first-class engineering to establish the matter on such a basis that others may be enabled to proceed with confidence in the outcome. The new company in Philadelphia is in a position, both financially and with respect to its command of the grade of engineering ability needful, to take the initiative, and map out the lines for others to follow. We believe that the distribution of exhaust steam will eventually add a source of profit to electrical generating stations, but in order for it to do so it will be necessary to take into careful consideration many circumstances whose full bearing will require close study and experience before the average central or power station manager can be reasonably expected to take hold. As remarked before, the Philadelphia project promises to practically establish on an extensive scale and in a certain manner the necessary principles, and therefore the decision arrived at is one of general professional and industrial interest.

Consolidation of Philadelphia Electric Lighting Companies.

Last week the Edison Electric Light Company and Pennsylvania Light, Heat & Power Company, of Philadelphia, were consolidated, and the new organization will add to its business the sale of exhaust steam from its stations for heating purposes. At least a million pounds of water, in the form of exhaust steam, are condensed at the Edison station daily, which can, under the proposed arrangement, be turned into the pipes of the steam-heating system, and beside the steam from the Pennsylvania Company's station it is thought some arrangement will be made for the exhaust steam from the various electric traction stations. The method of distribution will be radically different from that used in New York, as it will be delivered at 15 pounds per square inch, since heating only will be done by the steam.

The terms of the agreement are a guaranteed dividend on the stock of the Edison Company of eight per cent. for the first two years, and nine per cent. thereafter. This guaranty is backed up by most abundant and acceptable security. The Edison Company's capital stock is $2,000,000, of which there has been issued $1,847,222.22. It has been paying dividends of two per cent., quarterly, which are now guaranteed by this new arrangement, with an increase of one per cent. per annum after two years.

The capital stock of the Pennsylvania Light, Heat & Power Company is $10,000,000, which is said to have been subscribed several times over. It is divided equally into preferred and common shares of $100 each, and subscribers to $25,000 of the preferred stock get 50 per cent. additional in common stock when 20 per cent. is paid in. The first call of 10 per cent. has been made and a second call of like amount will be made next month. Over 80 per cent. of the stock was taken by Philadelphia capitalists, of whom there are about 150 interested in this enterprise. Among these may be mentioned William L. Elkins, William L. Elkins, Jr., Clement A. Griscom, W. W. Gibbs, W. W. Kurtz and Hamilton Desston.

An English Opinion of Prof. Forbes.

The comments of the American press on Prof. Forbes's notorious article in *Blackwood's Magazine* are both voluminous and amusing, says *Iron and Industries*. Our English contemporary confesses that to see the Professor stigmatising the typical American citizen as being addicted to "bounce" is rather grotesque. Prof. Forbes's claims in connection with the Niagara exploit may, it adds, be perfectly valid, and his pretensions to the sole glory of the thing quite susceptible of substantiation; at the same time, no one after reading the article would have the temerity to accuse the professor of any undue modesty. As an exhibition of bad taste and "sloppy" writing, Prof. Forbes's contribution is pronounced almost as unique as the achievement which it professes to describe.

Electric Lighting by Incandescence.

Some recent researches by A. Witz, reported in the *Comptes Rendus*, had for an object to determine the efficiency of lighting by means of incandescent gases. The gases are rendered incandescent by means of either an induction coil or a Holtz machine. In the first case the watts consumed in the tube can be determined, and in the second case the power consumed is taken to be the difference of the powers required to drive the Holtz machine at a given speed with and without the tube. The author finds that the efficiency of lighting by this method is much less than by the ordinary incandescent lamp with carbon filament.

A New Definition of Magnetism.

The author of a work on "Magnetism, Its Potency and Action, with Suggestions for a New Cosmography and a new Celestial Geography," gives the following definition of magnetism: "Magnetism is the connecting link between mind and matter, or rather the medium by and through which the Divine energy is imparted to all matter, and the primary exhibition of this energy is an exercise of God's will," and the Deity described is "the omnipotent magnet," and the author informs his readers that electricity is condensed magnetism, and that "electricity, light, heat, gravity, sound, capillary attraction, repulsion, attraction, disruption and explosion are modifications of magnetism, and are influenced by it."

October Meeting of the American Institute of Electrical Engineers.

The regular monthly meeting of the Institute was held at 12 West Thirty-first Street, New York City, Oct. 23, Vice-President Crocker in the chair. By special request of President Duncan, Mr. Thomas D. Lockwood had prepared for presentation resolutions on the death of Mr. Franklin L. Pope, which were read and unanimously adopted.

The resolutions refer to the great worth and high qualities of the deceased ex-president of the Institute, to his eminent services to the organization, and his able, unwearying and successful work in applying electrical energy to many useful purposes. By the death of Mr. Pope, called away in the full fruition of manhood and the meridian vigor of intellect, the profession at large is declared to have suffered an incalculable loss and the Institute deprived of a most distinguished and valued member, a wise and sagacious counsellor endeared to many members by long, pleasant and affectionate intercourse, and esteemed and respected by all, no less for his kindly and warmhearted nature, and dignified simplicity of character, than for his universally acknowledged genius and great abitity. Whether in the earliest days of the association co-operating in its successful establishment; urbanely and efficiently presiding as its chief executive officer at business and social meetings; discreetly and judiciously performing the unassuming duties of a member of the Committee on Editing, or in the capacity of an individual member and conserving the interests of harmony and stability; he uniformily had the dignity of the Institute at heart, and assiduously, cheerfully and faithfully labored in its interest and welfare.

The resolution of the Institute extends to the stricken family the tenderest sympathy, in this, the hour of their affliction, and in testimony thereof, a copy of the resolutions is directed to be forwarded to them.

The regular business of the evening was then taken up, a paper being read by Mr. Herman Lemp, Jr., of Lynn, on "Local Annealing of Hard-Faced Armor Plates." A paper on "The Rating and Behavior of Fuse Wire," by Prof. W. M. Stine, H. E. Gaytes, and C. E. Freeman, of Chicago, an abstract of which will appear in our next issue, was then read, in the absence of the authors, by the secretary.

The discussion upon Mr. Lemp's paper, an abstract of which is printed in another column, was participated in by Messrs. Lemp, Kennelly, Wolcott, Emery, Patterson, Kerr and Perry, and the following points were brought out: The size of the contact pieces is about three inches square, the points tapering to one inch square and rounded, so that at the beginning of the operation the actual contact between the copper terminal and the iron is only about one-half inch square. The iron is brought to a white heat, and a sort of hill formed under the contact point, into which the latter beds itself, increasing the area of contact and amount of work done. Mr. Lemp had never measured the resistance of the contact, but the secondary E. M. F. was two volts; the secondary current was computed from the primary current, which ranged between 75 and 100 amperes, the former current flowing when the hole to be annealed does not exceed 1⅝ inches, and the heavier current being required when working on a 2½-inch hole.

Automatic Regulation of Dynamos and Motors.

BY WM. E. GIFFORD.

If the armature of an ordinary dynamo be mounted on a sleeve, loose on the shaft, and connected with the shaft by a spring, the commutator being fixed to the shaft, any variation in the current will cause the armature to change its position relatively to the commutator, through an angle depending upon the variation in the current and the strength of the spring; and, the connections between armature and commutator remaining the same, the brushes will be taking current from a different part of the field, and consequently from points of either greater or less difference of potential, according to the setting of the brushes, which may be either before or behind the position of greatest difference, and different effects may be produced, tending to constant potential or to constant current, according to adjustment.

In Fig. 1, *A* is a ring armature, *B*, commutator, *C*, flange on commutator, *D*, brushes, *E*, springs, one for each section, attached to frame of armature, and to flange of commutator, with insulation, and serving also as conductors from armature to commutator. Three of these only are represented simply as corrugated strips. An additional spring may be used, either to take a part of the stress, or for purpose of adjustment; also, in some cases, a counter spring.

Fig. 2 shows the idea of a device intended to prevent vibration in case of sudden change of current or sudden starting. *F* is secured

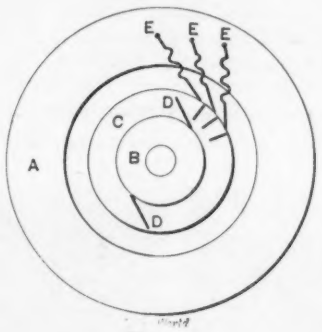


FIG. 1.

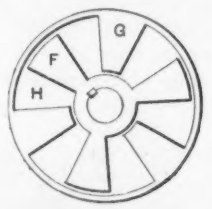


FIG. 2.

to the shaft, *G* to armature. The parts *G* are between cheek plates. and the parts *F* are free to move in the confined air spaces *H* with very little clearance, so that when any sudden change occurs, the escape of air from one side of *F* to the other allows the armature to take a new position promptly, without oscillation, and also prevents shock when *F* and *G* come together, as when the circuit is suddenly broken. In the case of a Gramme ring, this device may be placed inside the armature, and may form part of the frame.

In the case of a motor the operation is mechanically similar, the armature in this case running in advance of the commutator. The requirements of regulation are, however, somewhat different. In either case, the angle of variation allowable would probably be limited by a tendency to sparking.

Never having had an opportunity of constructing a machine on this plan, or practically testing the arrangement, I communicate the idea in its original crude form.

Electrical Properties of Selenium.

In the discussion of a paper having the above title, read by Mr. Shelford Biddle before the London Physical Society, Prof. Mitchell suggested that the selenium "cell" should be called the selenium "resistance." He could not agree that chemical action must necessarily follow the action of light in such a cell. Chemical action due to light may or may not occur according to the nature of the cell. Taking the case of the oldest photo-electric cell (the thermophile), it is asked: What chemical action can be shown here for the energy of the incident heat? Mr. Appleyard added that change of contact rather than change of structure appeared to him to be the most promising direction in which to look for an adequate theory of selenium resistances. Prof. Ramsey said that selenium is a substance on the border land between those bodies in which electric induction is metallic, and those in which it was known to be electrolytic. The author, in his reply, agreed that the name "selenium cell" was not an appropriate one.

Automatic Mercurial Air-Pump.

A mercury air-pump is described by F. Neesen in *Wied. Ann.* somewhat akin in principle to Geissler's, and may be called a reservoir pump. It is worked by an auxiliary water-pump, the mercury being raised and lowered in the reservoir by the automatic motion of two valves which allow the mercury in the cistern to be exposed to the atmospheric pressure, or freed from it by the action of the auxiliary pump. The peculiarity of the automatic valve-motion is that the valves are moved by a system of floats, of which one part varies its weight by admission and recess of mercury, so that there is the necessary difference of level in the cistern between the phases of valve-opening and closing, corresponding to whether the mercury is rising or falling. The adjustment for preventing too rapid rise of mercury as the pressure falls below 1 mm is made by withdrawing a little mercury from the cistern into a side vessel. The author describes an arrangement with a tap instead of valves, the difference of phase in action being effected by an automatic variation of the leverage acting on the tap.

Electricity on Canals.

An official test of the Lamb method of propelling canal boats by electricity took place on the Erie Canal at Tonawanda, on Oct. 26. A boat was towed for a distance of about one mile and a quarter along the south side of the canal in both directions. The first trip was up the canal against wind and current, and a speed of about three and three fifths miles per hour was made. On the return trip five canal boats were towed along at a speed of four and seven-tenths miles per hour. The test was pronounced a success by all those present.

In Fig. 2 is shown the line erected at Tonawanda, and Fig. 1 shows the system as operated in a North Carolina lumbering dis-

Fig. 1.—Electric Lumber Haulage.

trict, where it has been in successful use for some time. In preparing a line for its use brackets are erected upon posts or supports, and saddles are placed upon the brackets having insulated material between them. A bracket is also provided to support the lower or traction cable. A one and one-quarter inch steel cable is supported upon the upper saddles and a four-eighths inch steel cable upon the lower. In canal boat towing the cable line is placed on the inward side of the tow-path. The bearing cable is placed at an elevation of sixteen feet from the ground, and the traction cable three feet below it. The motor truck is made with two deep grooved wheels to run on a cable, having a horizontal axle between them and below their centre line. Upon the axle is suspended a hanging frame, having attached to it an elliptically grooved sheave, which is revolved by means of a worm or wedge-gearing, driven by a 15-kw electric motor with vertical shaft, all attached to the swinging frame of the car. By taking three turns of a five-eighths inch cable around the elliptical grooved sheave, when the electric motor revolves the gearing, the sheave winds up, and at the same time plays out on the five-eighths inch cable, thus pulling along the car. It is in this way that the motor gets its tractional friction independent of the weight of the apparatus.

A 500-volt current is used. It is taken from the main cable through the wheels, thence through the axle to the axle-box of the hanging frame. Here an insulated copper wire connects it with the rheostat. The current is returned through the traction cable, which is grounded at intervals, giving a combined ground and metallic conductor for the return current. The return current is passed through the axle of the elliptical grooved wheel; thence on to the five-eighths inch wire to the brackets, and thence through a wire to the ground.

The motor is not confined to a straight line for its ability to operate, for when it reaches the bracket, the traction cable is lifted from the saddle momentarily, and the car can take a new course. The saddles are made so that the wheels leave the cable and ride over on their flanges, in the channels of the saddles made for straight line or right or left deflections. The main cable is used as the electrical conductor.

The worm gear, especially made for this electric motor, is designed to work both ways, and has ball-bearings at either end of the worm, to lessen the friction and thrust. It differs from the ordinary worm gear in that it has more than twenty times the bearing surface of an ordinary worm and wheel, moves two teeth of the gear wheel at each revolution of the worm, and works on the principle of a wedge rather than an inclined plane. The gear wheel, worm and ball-bearings are encased in a jacket filled with oil. Thus the minimum loss of power is effected between the electric motor and the elliptical grooved wheel. The gearing was necessary in order to lessen the speed, as the electric motor is run at 1240 revolutions per minute.

When a motor is to be run without any boats in tow, its rheostat and conducting-wire tow line is placed upon the motor, and a driver seated on a seat on the electric mule operates the same.

A rheostat on the canal boat regulates the speed and reverses the current, and has an automatic switch. Four insulated copper wires armored with steel wire form the cable that conducts the electricity from the bearing cable to the rheostat and back of the motor, and at the same time acts as the tow line. The upper end is clamped to a ring that runs on a traveler situated on the frame of the motor about the lower part of the elliptical wheel. A long steel clamp with toggle joints is used to hold the towing cable at any point desired, and has a ring in one end, to which is attached a short length of rope, which is made fast to the sampson post of the boat. The end of the towing cable is carried to the rheostat on the boat, where it is coupled to a similar piece of cable wired to the terminals of the rheostat. The couple is designed so that it is impossible to join other than the right wires together, and the contact is made quickly and securely.

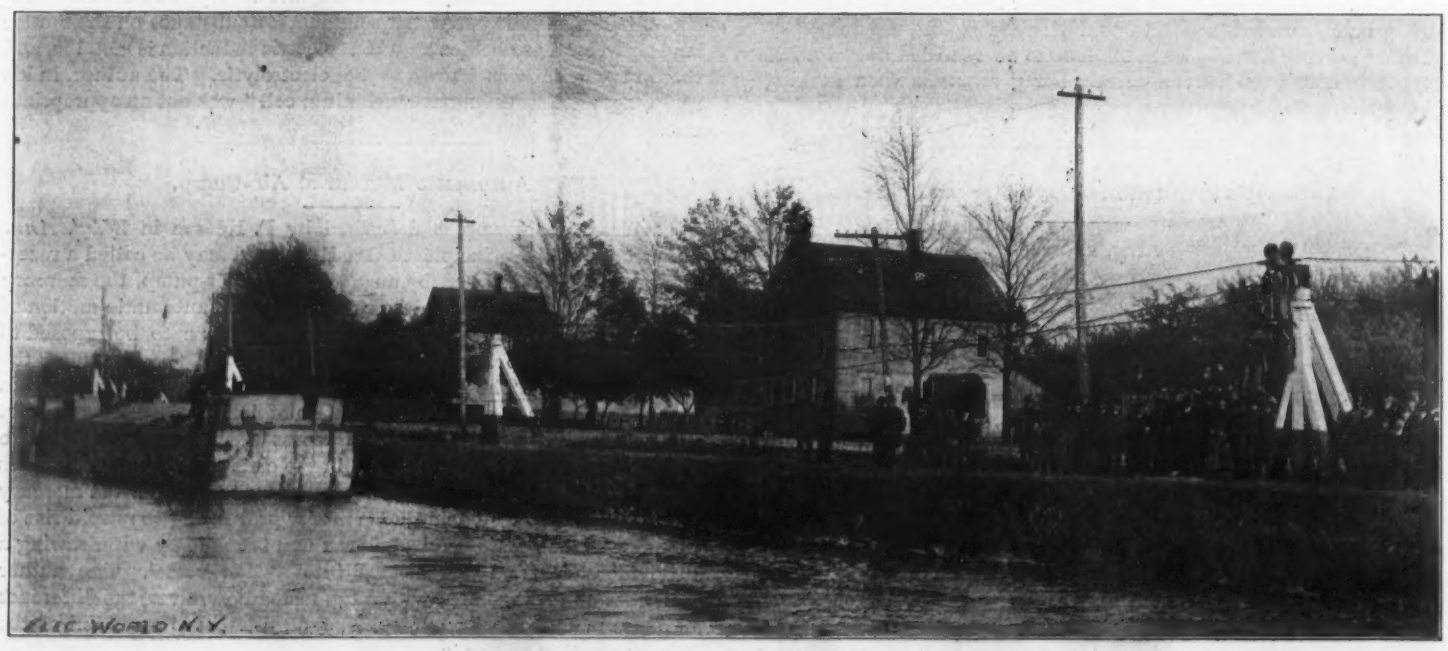


Fig. 2.—The Lamb System of Haulage Along the Erie Canal.

The Electrical Engineering Department of the University of Illinois.

FOUR years ago the term "electrical engineering" was almost unknown at the University of Illinois. To-day, it designates the largest department in that prosperous university. Under the vigorous administration of President Andrew S. Draper and the wise policy of the trustees, and with the generous support given by the United States and by the State of Illinois, this department of the university gives promise of speedily acquiring a place in the first rank of the electrical engineering schools of America. So far as this department has to do with engineering education, the hopes of Prof. Jonathan B. Turner, a distinguished citizen of Illinois, to whom all State universities owe a great debt, are being rapidly realized.

Prof. Turner was, perhaps, the first advocate of State industrial education in America. In November, 1851, at a convention held at Granville, Ill., he gave the first formal statement of ideas original with him, concerning the endowment of educational institutions by the general government, through the appropriation of public lands to the several States. The movement thus started resulted ten years later in an act of Congress, known as the Morrill Land Grant Act, in accordance with which nearly fifty land grant institutions have been established. The University of Illinois, located at Urbana, Ill., owes its origin largely to this act.

This university is composed of four different colleges—college of literature and arts, college of engineering, college of science, and college of agriculture.

The State of Illinois now supplies most of the means for the support and development of its university, and it does this liberally. Within the last three years, the college of engineering and the college of science have each been provided with large and handsome new buildings, devoted exclusively to their special requirements. At its session just ended, the State legislature appropriated nearly a half million dollars for buildings and improvements.

PLAN OF ENGINEERING HALL, FIRST FLOOR.

The college of engineering consists of the departments of architecture and architectural engineering, civil engineering, electrical engineering, mechanical engineering, municipal and sanitary engineering, physics, and theoretical and applied mechanics.

The college of engineering building, known as Engineering Hall, is a large four-story stone and brick structure devoted exclusively to the uses of the several departments of the college of engineering. Each department is also provided with laboratories that are entirely independent of this building.

The Department of Electrical Engineering, to which this article is devoted, has extensive quarters in Engineering Hall, and in the basement of the east wing of University Hall. The class rooms, drafting rooms, seminary rooms, studies, and most of the testing rooms are in the former, while the dynamo laboratories, storage-battery room, photometry room and workshop are located in the latter.

For the laboratory work of the junior year, the year in which the electrical engineering students begin to receive special training in electrical engineering subjects, there are eight testing rooms, each supplied with masonry piers, dark curtains and other necessary appliances. Great care has been exercised, both in the selection and in the furnishing of these rooms, in order to prevent magnetic disturbances due

ENGINEERING HALL.

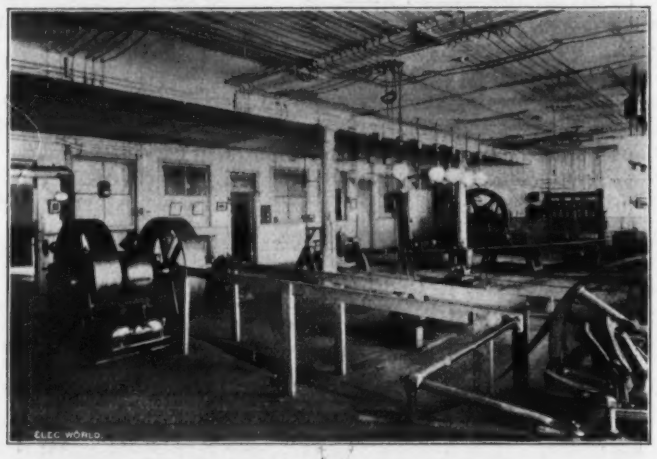
to varying fields of force. Many of the more delicate instruments are allowed to remain permanently in position, thus insuring greater accuracy in their use.

For the work of the senior year two dynamo laboratories are provided, one for direct, the other for alternating-current machines. A 50-hp "Ideal" engine, belted to a line shaft, furnishes power for both. In addition, power is also obtained from the Champaign Electric Light & Power Company. The dynamos installed are a 6-kw Edison compound, 125 volts, a 3-kw Edison compound, 500 volts, a 3-kw Thomson-Houston, 110 volts, and a Weston, 110 volts and 18 amperes. A Jenney 5-hp shunt motor, and a United States 1-hp shunt motor are available for use on 500 volt circuits. For the study of arc lighting, there is provided a 10-light brush and a 3-light Thomson-Houston arc dynamo. The latter has been specially fitted up with extra sets of collector rings to enable it to be used also for three-phase work. A 300-light Thomson-Houston alternator, two single-phase Westinghouse pony alternators and a large number of the leading makes of transformers constitute the equipment for alternate-current work.

The department is well supplied with apparatus from the leading makers of Europe and America. Among the latest additions may be mentioned a set of Weston direct and alternating-current wattmeters supplied with multiplying coils. For potential measurements, the instruments include several Weston direct and alternating-current voltmeters, two Kelvin electrostatic voltmeters, Cardew voltmeters, Kelvin and Rpan electrometers, and various types of potentiometers. For current measurements, two Kelvin centi-ampere and composite balances, a large number of Weston ammeters, several ammeters of Whitney, Ayrton & Perry and other types, two Siemens electro-dynamometers and a large number of galvanometers of all kinds. Considerable apparatus has been made in the workshop of the department, among which may be mentioned a fine line of

galvanometers and much accessory apparatus for experimental work of various kinds.

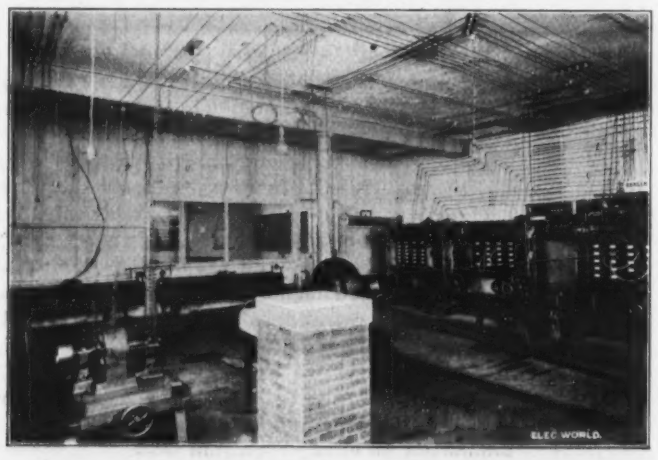
The instruction in the course in electrical engineering throughout the freshman and sophomore years includes courses in mathematics, English, French or German, drafting and machine design, and shop work. Physics is taught during the sophomore year. In the junior year courses in theoretical and applied mechanics, chemistry, mechanical engineering laboratory, and electrical measurements are taken. The seniors devote most of their time to the study of steam



Direct-Current Dynamo Laboratory.

engines, dynamo-electric machinery and the various devices found in commercial applications of electricity.

The laboratory work in the junior year consists of standardization of instruments and a carefully arranged series of experiments in electromagnetism. In the senior year the work involves the operation and testing of such machines and appliances as are available; the study of arc and incandescent lighting and of power systems. The work of drafting and designing includes the design of electromagnets, direct-current dynamos, transformers, lighting plants and power transmission plants. Lectures are given on the mathematical theory of electricity and magnetism; the theory of alternating-currents and its application to alternate-current working; and the application of electricity to telephony, electro-metallurgy and photometry. The seminary work offers an opportunity for systematic reading of the best periodical literature on the theory and applica-



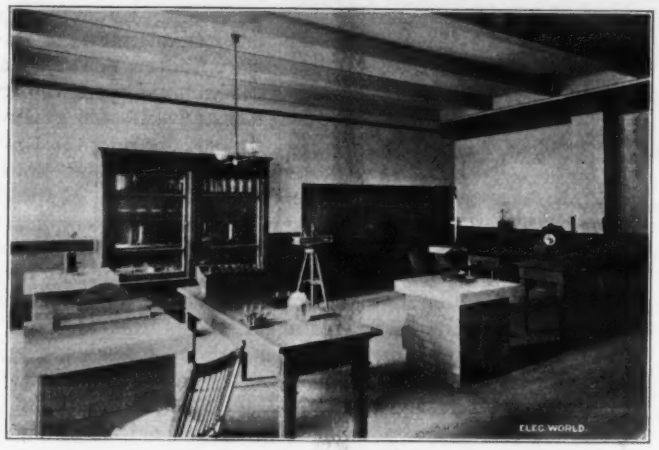
Alternating-Current Dynamo Laboratory.

tions of electricity. Department reading rooms, where the leading American, English, French and German journals are kept on file and in which are held weekly meetings of instructors and students, are provided for the junior and senior classes.

Opportunities for experiments and investigation, additional to those offered by the department, are provided by the lighting and railway companies, and manufacturers in the vicinity of the university and in remote parts of the State, that have made their plants and electrical appliances available to the department, for testing and for special work. The Champaign Electric Light & Power Company's plant particularly affords splendid opportunities for the study of light and power distribution and of street railway equipment and operation.

Extensive visits of inspection are made at least once a year to prominent manufacturing establishments and to important electrical installations in large cities.

One of the most important parts of the work in the course is the preparation of a good thesis. Early in the senior year, the student is required to select some subject which shall furnish opportunity for study of such a character that the resulting thesis may be a valuable contribution to engineering knowledge. He must familiarize himself with whatever literature there may be on the subject, and he is



A Testing Room.

thrown largely upon his own resources in the selection of the methods and the prosecution of the experimental work.

An annual, known as *The Technograph*, published by the Association of Engineering Societies at the University of Illinois, affords ample opportunity for publishing the results of such experiments and investigations.

The purpose of the department of electrical engineering is to give young men the best possible preparation for their chosen work. Its success in this direction is shown by the number of graduates of this department who are holding positions of trust and responsibility, many of whom are doing work that reflects much credit upon themselves and honor upon their Alma Mater.

At the head of this department is Dr. Daniel W. Shea, professor of physics and electrical engineering. He is assisted in the work of

Designing and Drafting Room.

instruction by Bernard V. Swenson, assistant professor of electrical engineering; William Esty, instructor in electrical engineering; and Fred. A. Sager, instructor in electrical engineering.

Doctors and Electrical Science.

In condemning the views on the subject of electric shock, put forth by two writers in the *Lancet*, and which are declared to be opposed to known facts of electrical science, the London *Electrical Review* asks, "When such hazy and inaccurate ideas on electrical questions are to be found even among professional medical men, is it surprising that the non-professional public should be so easily taken in by the electro-medical quack?"

Electric Annealing.

In a paper read before the American Institute of Electrical Engineers at its October meeting, Mr. Herman Lemp, Jr., read a paper describing a method of electrically annealing small portions of hard faced armor plates where it is necessary to pierce them for fastening bolts or other purposes. The protected armor of battle ships is always treated for hardening by some process, usually the Harvey process, which latter for a depth of an inch or less hardens the material so that in property it resembles tool steel, thus necessitating local annealing where holes are to be pierced or any parts cut away.

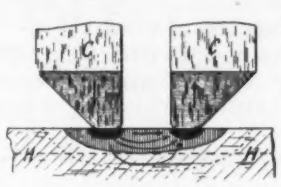


FIG. 1.

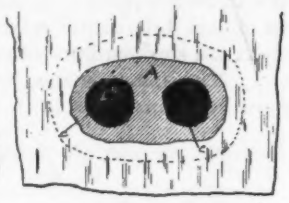


FIG. 2.

Figs. 1 and 2 show a method of introducing the electric annealing current, *C C* being two copper contacts cooled by water circulating inside. The current enters the plate by one contact and leaves it by the other. Right under the contact the metal comes to a bright cherry heat (shown in black), while the portion intervening and partly surrounding the contacts acquires just a visible red temperature. The line *H H* indicates where the influence of the Harvey treatment stops. The shaded portion in Figs. 1 and 2 shows a zone softened and ready to be machined, while the dotted line indicates how far the heat radiation would cause the metal to turn blue. When cool, the annealed portion showed a chocolate color, while the places where the contacts have been resting are scaled and hard, and cannot be touched by tools to a depth of about a quarter of an inch. These places can again be annealed later on, if required.

The apparatus necessary to carry out this process consists of a generator, an annealer or transformer, and a regulating apparatus. The generator is commonly a separately excited alternator of variable potential and a maximum of 500 volts and 100 amperes, the best frequency being 50 periods per second. A copper-clad type of transformer is used having a ratio of transformation of 100 to 1, of which the secondary is composed of two copper castings, each having a rectangular groove; the two halves when bolted together form a closed rectangular frame enclosing the primary. The hollow space intervening between the primary and secondary is filled with a heavy oil which acts both as the insulator and as a conductor of heat. The primary is a copper ribbon insulated with asbestos. The transformer is suspended like a compass in gimbals, so that it may be used in any position desired. The copper castings which compose the secondary arc cut through at one place in the circuit, and on either side of the cut two short platforms form the base of the copper contacts, which are of various shapes and sizes, and by means of which currents are made to enter and leave the plate to be annealed. Fig. 3 shows some of the shapes of contacts used for different purposes. They are all of forged copper and hollowed for a water circulation for cooling purposes.

The weight of the whole annealer is about 1,000 pounds, which is

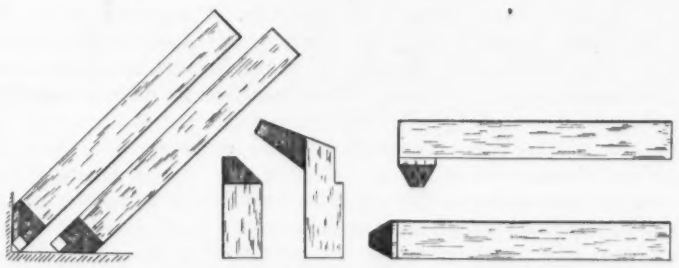


FIG. 3.

sufficient for a proper contact pressure for all work on a horizontal plate. For vertical plates it is proposed to use a pair of electromagnets to hold the annealer against the surface. The contact surface is seldom more than one half an inch square, and yet 10,000 amperes, equivalent to 40,000 amperes per square inch, are made to flow through it continuously, the copper contacts being kept cool by water circulation.

The regulating apparatus in most cases is simply a rheostat in series with the field of the generator. When more annealers than one are run simultaneously from one generator, a reactive coil is interposed, consisting of a solenoid coil or cable, having a movable laminated iron core, which may be raised out of the coil by means of a winch. The core is composed of thin iron slips placed side by side around a circle and projecting radially, being held on the top and bottom by insulated discs similar to the manner copper segments of a commutator are secured. The regulation is made automatic by means of oil dash pots. The core, once raised out of the coil, tends to return by gravity and the attraction of the solenoid, but is checked in its descent by a pair of communicating dash pots, one on each side of the coil; one of these has a piston provided with a valve which opens when the core is raised and closes when the core descends. An adjustable bypass, which allows the oil to flow from the tube to the top side opposite, enables the rate of descent, and consequently diminution of current, to be automatically and uniformally obtained.

The annealing operation is carried out as follows: The transformer is placed in position with the contacts touching the plate on each side of the place to be annealed, and the primary current is brought up by means of a rheostat to from 75 to 90 in two minutes, according to the size of the spot to be annealed, this bringing the metal to a dull red heat. If no reactive coil is used, the current is now diminished by turning the rheostat one coil per minute. If the reactive coil is used, the core is raised by a winch, the coil put in circuit by opening the short circuiting switch and then allowed to descend on its own account. The operation generally takes seven minutes all told.

An important extension of this process is the annealing of gun shields where they have to be cut for the gun opening. In this case the apparatus is arranged to move along a line to be annealed, the motion being obtained by an ordinary screw and nut held in a bracket, the nut being turned at a speed of about one fourth of an inch per minute. A strip about two and one fourth inches wide through the length over which the machine had been moved is thus prepared for working by drills or shapers, and in a manner as com

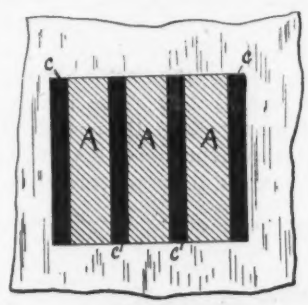


FIG. 4.

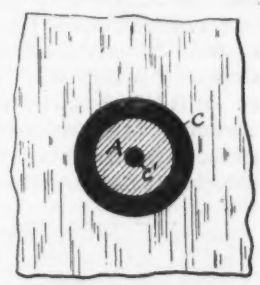


FIG. 5.

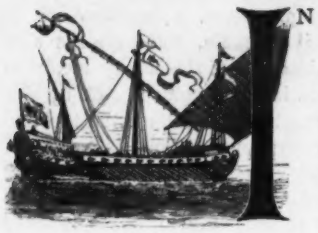
plete as if the metal had never been hardened. As mentioned before, the places where the contacts are passing over the plate being brought to a higher temperature than elsewhere, remain hard. Experience has demonstrated, however, that they may be reannealed later on, by treating the spots in the same way as any other spot on the plate. This method is shown in Fig. 4, in which a series of strips are annealed side by side as shown by the shaded lines, *A*. The hard-faced surface is then removed from such places by a planer or drill. The machine is then run a second time over the annealed strip, resting this time on the bottom of the groove and on the softer metal, and the ridges *C*, left between the strips, just annealed, are similarly treated. When all these strips have been annealed they may be removed with machine tools without any further difficulty. In a similar manner a large round place may be annealed as shown in Fig. 5. The transformer is set on the plate, one contact resting on C^1, and the other at any other place in the circle *C*; the apparatus is then slowly revolved around the contact C^1 as a centre until the second contact has completed the circle *C*. The shaded portion *A* now represents the annealed surface, which is removed by a cutting tool. The contacts are then made to rest on either side of the centre *C*, and the latter is annealed and removed in its turn.

Professional Boorishness.

In referring to some gross violations of professional etiquette, the London *Electrical Review* says that the scramble taking place among the younger members of the electrical engineering profession is a spectacle viewed with regret by all reasonable men.

Electricity in the Italian Navy—III.

BY GUILIO MARTINEZ.



IN the class of vessels under consideration, the design has been to install the circuits in such a manner as to insure, except in the case of an unusual accident, that no derangement of a main circuit will occur even if it be cut at a single point. To that end, the circuits are disposed as follows :

The mains of circuit I form a long rectangle which leads entirely around the boilers and engines on the two sides of the vessel, each of the two conductors having a section of 128 mm². The rectangle is almost 230 feet in length, and the two long sides are connected at the middle point by an athwartship conductor of 77 mm² ; the distribution of lamps being almost symmetrical with respect to the two portions into which the circuit is thus divided, this latter conductor has an importance only in insuring the operation of the installation if the main circuit should be broken at a point. The mains are protected along their entire length by out-board coal bunkers and by the armored deck, in the same manner as the vital parts of the ship, or even better ; for they are enclosed in an iron pipe perfectly water-tight, and where branches lead out there are water-tight connection boxes of a special construction. By means of this iron tube, a water-tight system is constituted within the water-tight compartments of the vessel. In each of the latter there is a single connection for the illumination of that compartment, which can be flooded without the main conductor being affected by the water, the local installation alone being damaged. The latter, aside from the water-tight connection boxes, possesses no novel features, consisting of a main, branches with cut-outs, etc. In other words, there are as many installations as there are water-tight compartments and the large rectangular system merely constitutes a large distributing feeder or network.

Circuit II is more complicated. It runs principally above the water line and the numerous water-tight compartments. The system forms a network similar to the one described above, and situated on the two decks above the armored deck. The first of these two systems consists of a cable of 77 mm² with an athwartship conductor of 57 mm². It is led along the deck immediately above the armored deck, and does not extend beyond the turrets at the two extremities of the ship. The circuit is fed by two conductors of 128 mm², which have different leads from the switchboard to two points distant from

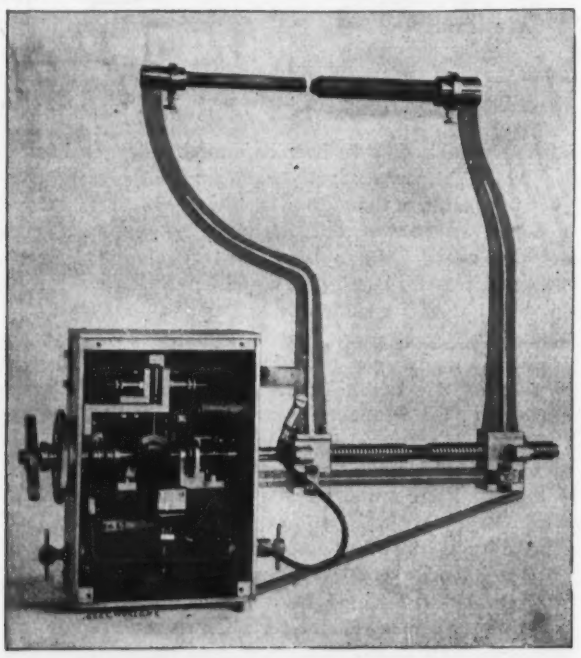


Fig. 12.—Standard Arc Lamp for 40-cm Search-Light.

each other on the short forward portion of the rectangle. Two trunks of reduced and decreasing section lead to the more distant forward portion of the ship. On the upper deck is a second network, the outside conductor having a section 57 mm², and the athwartship connection a section of 32 mm², and fed by two conductors of 77 mm² which lead out from the lower network near the two feeders to the latter from the switchboard. From these two main circuits a large number of groups of lamps are fed, each with its double fuses and switch.

Circuit III consists of a large rectangular network system protected in the same iron pipe as circuit I, with an athwartship section of 77 mm² and outside sections of 128 and 77 mm². Branches are taken from the same water-tight connection boxes as circuit I for running ventilators.

Circuit IV follows the same path, but its network has an athwartship connection of 128 mm² to which a connection is made for a motor of four hp.

Circuit V forms another protected network, which extends, however, only to the athwartship connections of the other circuits. It is designed to feed three arcs of 90 amperes, of which two are utilized for the port and starboard projectors, and the third for a mast head projector. The latter, made by Sautter-Harlé, can be operated from below by means of an electric motor contained in its base.

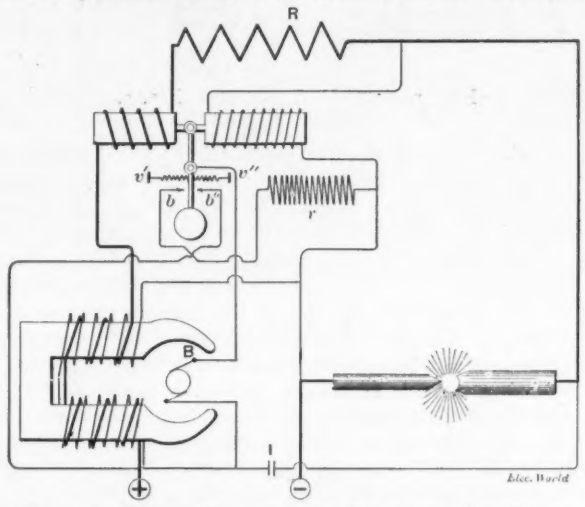


Fig. 13.—Wiring Diagram of Standard Arc Lamp.

All the projectors are provided with Mangin reflectors and automatic regulating lamps of the Pasqualini system. There are two styles of these lamps: the old type transformed from hand regulating lamps and with inclined carbons; and the modern type with the carbons situated in the axis of the luminous rays. This last type comprises two models—one for 50 and one for 90 amperes. The horizontal or more recent type, differs from the old or vertical type by the different disposition of its mechanism, but the operation is the same. It is a lamp with a differential regulator and a fixed luminous point.

The regulator has a differential solenoid which acts on a relay, which, in turn, gives motion in one direction or the other to a small motor. By means of a very simple gearing this motor turns a rod carrying two screw threads, one right and the other left-handed; the nuts of these threads, which have a different pitch, carry the carbons. The 50-ampere lamp is shown in Fig. 12, in which one of the sides is cut away in order to show the interior. On the opposite side there is a little lever which throws out the motor-gear and permits the lamp to be regulated by hand by simply turning the carbon-holder rod. On the other side of the lamp there is a simple and inexpensive compensating resistance of .3 ohm formed of several arc carbons of a convenient diameter.

Fig. 13 shows the connections of the lamp. The field cores of the motor have a double winding in order to insure at all times a strong field. The armature is supplied with shunt current, taken from the arc if it is desired to approach the carbons, or from the regulating resistance if they are to be separated. When the lamp is put in operation, the carbons being separated, the fine wire coil of the solenoid acts alone. The movable system of the relay is balanced by counterweights and springs in such a manner as to be unaffected by the inclination of the apparatus, and carries the brush, *B*, of the armature into contact with a stop, *b*, connected with the negative carbon; the other brush is always in communication with the positive carbon. The field magnets being then excited by the current from the fine wire coil, the armature turns and brings the carbons into contact. Scarcely has the arc been thus established when the current, which is of considerable strength for some instants, gives a predominating action to the large wire coil of the solenoid, and reverses the current in the armature by putting the brush, *B*, in contact with the stop, *b'*; that is to say, with a point that is positive in relation to the positive carbon; the armature then turns in the opposite direction in

the field due to the total current circulating in the large wire winding of the field magnets. The separation of the carbons continues until the arc has attained the length desired, a length which can be varied by regulating the screws v', v' and the stops b, b''. The lamp, whose sensitiveness is remarkable, can be regulated very satisfactorily for different values of current between the limits of 15 and 60 amperes.

In the diagram, I is a switch which is opened when the lamp is to be operated by hand, and r a non-inductive resistance of almost 80 ohms, which reduces the current in the armature when it is shunted on the arc. In regulating a lamp when newly constructed,

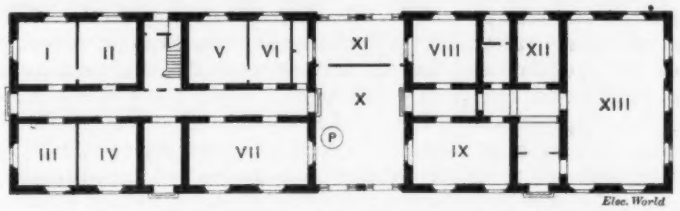


FIG. 14.—PLAN VIEW OF SAN BARTOLEMEO LABORATORY.

the best value to give this resistance is found by trial, and varies but a few ohms in different apparatus. The 50-ampere lamps only weigh a few pounds; their dimensions are much reduced and their cost very moderate, and they give complete satisfaction on naval vessels. It is certainly one of the best regulating lamps for very strong intensities that has yet been made.

I have given a rapid glance at the applications of electricity in the Italian Navy. When I remark that the tendencies of the day are toward increasing the number of electric motors on vessels, and apply them to the working of guns, of pumps and of auxiliary mechanisms, I will have indicated, also, the programme of the innovations which it is proposed to realize, simply adding that no novelty is introduced which does not beforehand give almost complete assurance of its success. Proceeding on this principle, the advance is slow, but it is realized that a failure retards instead of advancing development.

I do not, however, wish to terminate this sketch without giving some account of the organization of the electrical service from its technical side, and of the centre of the electro-technical studies of the navy—that is to say, of the laboratory of S. Bartolomea, at Spezia.

This laboratory is not the only naval one, but it is the largest, the oldest and the most important. It is there that questions relating to new apparatus and material and new types of installation are solved, and tests made of material supplied by private firms. Fig. 14 gives a plan view of the laboratory, which occupies the ground floor of a large building, the floor above being used as a chemical laboratory. Connected with the laboratory is a generating station with two Victoria dynamos of 110 volts and 200 amperes, one Victoria dynamo of 54 volts and 80 amperes, and one Edison dynamo of 65 volts and 50 amperes, all direct-coupled to Tosi engines. In the gallery there are for the trial of steam engines and dynamos four foundations for the simultaneous operation of four sets and a Tangye engine of four hp to test dynamos not having their own engines. In this gallery there is a rheostat with a special commutator to absorb the maximum capacity of a dynamo of 65 volts and 300 amperes, and so designed that the current may be varied to enable the characteristics of dynamos to be determined. This gallery is connected by five lines to the generating station, and by five lines to the laboratory, which latter is thus always connected both to the generating plant and to the generators under test in the gallery. In the gallery there is also a special condenser to condense the steam of engines under trial, it being considered that this means is the surest to determine the consumption of steam. The engines are ordinarily tested with steam taken from the general workshop steam service, but there is a special boiler for the cases when an independent supply is considered to be absolutely necessary. A switchboard, with commercial measuring apparatus, completes the installation of this gallery, where the tests

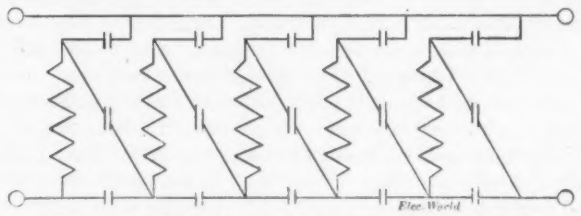


FIG. 16.—DIAGRAM OF RHEOSTAT CONNECTIONS.

have a character essentially industrial. Finally, as a branch of the laboratory, there is a winding department where parts of dynamos are either repaired or newly made, which work is accomplished with very great perfection.

Returning to the principal laboratory, Room I is arranged for the commercial standardizing of instruments of measure, for the final regulation of arc lamps, for the study and testing of arc carbons, and, at times, for taking the characteristics of dynamos. Into this room lead the five lines from the gallery, and from it are taken all interior circuits, which have connections in each room. There are also circuit changers and two rheostats, of which one is adjustable from 10 ohms to .1 ohm and can absorb 500 amperes; the other is adjustable from 4 ohms to .16 ohm and can absorb 150 amperes. The commutators of these rheostats are mounted as shown in Fig. 16, from which it is readily seen how the different values of resistances are obtained. Ships' instruments are standardized by means of Weston instruments, which in turn are standardized by means of Thomson balances or standard cells.

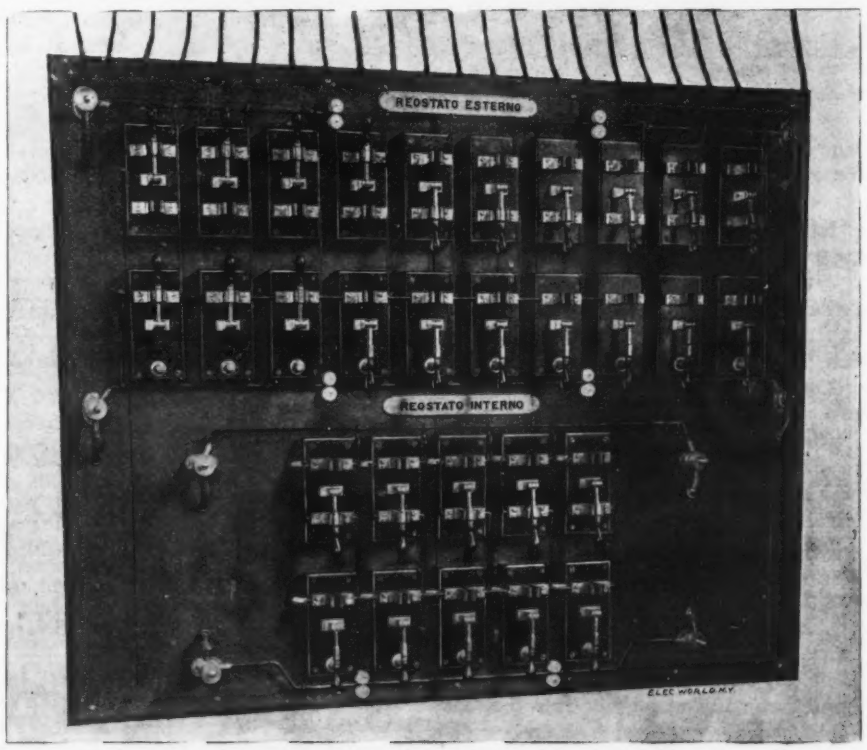


FIG. 15.—SWITCHBOARD FOR TESTING RHEOSTATS.

Room II is used for photometric measurements of incandescent lamps. There is a Bunsen photometer, arranged in such a manner as to operate very rapidly in testing lamps before acceptance. The standard lamp is a Hefner-Alteneck, but special incandescent lamps of 12 cp and 63 volts, for example, are also employed, after being very exactly measured. This standard lamp is put into the photometer and a position sought which will give on the screen the same illumination as the fixed Hefner lamp. The lamps to be tested are then substituted for the standard lamps and the current varied to bring them to a normal incandescence, and the number of volts and amperes then read. The conditions of acceptance are quite rigorous. All the lamps are tested to insure that the filament is intact, and 10 per cent. are measured photometrically, and the entire lot rejected if five per cent. of the lamps measured do not come up to the normal requirements. From time to time tests are made on the duration of life of lamps and their efficiency after a certain number of hours in use, the purpose being to insure that the product continues good.

Room III is occupied by draftsmen, and Room IV is a small workshop whose principal purpose is the repair and maintenance of experimental instruments and apparatus, but at times special apparatus is there constructed. For this latter purpose, it may be remarked, recourse can also be had to the other workshops under the cognizance of the torpedo department, to which the laboratory is attached. Rooms V, VI and VIII are occupied by electricians and served as offices. Room VII is for measurements of precision which are frequently made. Here there is a very fine collection of instruments, consisting of Thomson, Siemens and D'Arsonval galvanometers, standard resistance boxes, condensers, standard cells, and even a fine electrostatic machine. A large Elliott-Wheatstone quadrant bridge is used in connection with the Siemens galvanometer. A key bridge is also used for the measurement of installations in connection with a Thomson galvanometer and a battery of 140 volts. All cables are tested for insulation. In the latest specifications the insulation ought to exceed 1,000 megohms per kilometer for large cables, which limiting value is raised to 4,000 megohms for smaller cables. The measurements are made 24 hours after immersion and referred to a temperature of 25°C. The insulation accepted is that which corresponds to the deviation of the galvanometer after one minute of charge. The cables to be tested are immersed in the tank, *P*, of the central gallery, *X*.

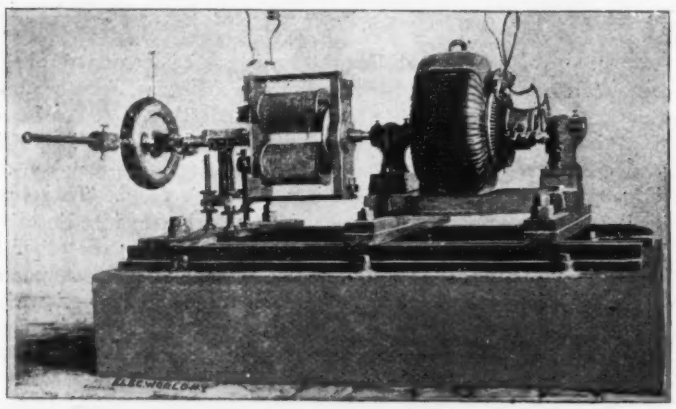


Fig. 17.—Pasqualini Magnetic Brake.

Room IX is for measurements of high precision requiring considerable time, or which are very special in their character. It is equipped with galvanometers, electrometers, registering apparatus and standards of the highest rating, and is the *sancta sanctorum* of the laboratory. The central portion, *X*, of the building is used for tests of material of large size or considerable weight, as, for example, electric motors, ventilators, etc. The method of testing electric motors is special to this laboratory, an electromagnetic brake being employed which was designed by Prof. Pasqualini, chief electrician of the navy. On the shaft of the motor is secured a disc of copper, so as to turn, without pressure on the bearings, between the poles of an electromagnet, the latter resting on a steel knife edge and counterbalanced with weights. When the electromagnet is not excited the motor turns freely, but if a current is sent through the coils the motor is submitted to a braking effect which is flexible and obedient to the highest degree, for by regulating the exciting current with a rheostat any value desired can be given to the resisting couple. This couple is very easily measured. The movable system of the magnet carries two horizontal arms, on which slide two weights of known value. The couple is thus weighed with the greatest of facility, for it merely suffices to bring the arms to their horizontal position. The distance of the weights from the axis multiplied by their weight evidently gives the value of the couple exerted on the disc of copper turning in the magnetic field.

This brake is of a very practical application to high-speed motors up to several horse-power. If a well-standardized tachometer is used mechanical measurements of the power of the motor can be taken to the same degree of exactitude as the electrical measurements. The efficiencies thus obtained have therefore a remarkable exactitude, and the different conditions under different loads can be studied to perfection.

The brake is shown in Fig. 17 applied to a motor of 4 hp. With this type (of which the sketch enables approximate dimensions to be obtained, the height of the base being 30 cms, the length of the sliding base on which the apparatus rests 150 cms, and the length of the anterior arm of the lever 50 cms) 1.25 hp can be absorbed at 100 revolutions with an expenditure of 500 or 600 watts for the excitation of the brake.

Room XI is occupied by a battery of 80 accumulators of 120 ampere hours capacity, and a number of other elements of different systems which are kept as models. The central hall to the left is used for arc-photometry, to which end the walls are painted black. A large room XIII, and the cabinet, XII, finally, are reserved for officers in attendance on the course of electro-technics here taught, or making special studies. These have at their disposition a complete collection of special apparatus.

If it is considered that in this country applications of electricity, notwithstanding some great installations well known everywhere, have not, up to the present, had the extensive development received elsewhere, and particularly in the United States, it can be truly said that the organization of the electrical service in the royal marine and the general character of its installations constitute one of the most important applications in Italy, while the electro-technical laboratory of San Bartolomeo, at Spezia, is one of the best equipped, both in instruments and methods. Scientific researches and measurements of precision are there associated with industrial testing, with the practical construction of machines and the installation of apparatus, and its field of work is always increasing. In terminating this sketch, I wish to mention in a few words some of the ordinary work there accomplished, not counting that done in original design, such as in plans for new types of installations, studies of new material and measurements purely scientific, there are tested on an average each year 30 to 40 generating sets, of which the steam consumption is often determined, diagrams taken, characteristics determined and measurements of the resistance and insulation of the dynamos made; an average of 4,000 dry batteries and 2,500 lamps are tested; 500 or 600 measurements of cable insulation are made, 700 to 800 measurements of resistance, 100 measurements of conductivity, and 200 measurements on an average of different kinds of cables in use (telegraphic and telephonic lines, torpedo lines, installations of vessels, etc.), from 100 to 150 ammeters and standardizers and almost as many voltmeters. The number of electric motors tested is always increasing, and the same can be said of electric ventilators, of which the great utility is now generally admitted. During later years a series of very important experiments have been made on ventilators, and are being continued at present on new types. This work has led to very useful knowledge on the operation of ventilators, of which little is generally understood. Those interested in electric ventilators will find the subject very clearly treated by Prof. Pasqualini in the numbers of the *Revista Marittime* for December, 1893; May, 1894, and February, 1895. In these articles are given the results of experiments and the plan to be followed in the rational study of the ventilator.

The Invention of the Electromagnetic Telegraph—VII.

BY STEPHEN VAIL.

One of the biographers of Alfred Vail has in very appropriate terms described his personality as follows:

"In person Mr. Vail was about the medium height and of slight frame. His complexion was fair; his eyes large, lustrous and unusually soft, but often fired with deep earnestness. There was nothing of the visionary about him. He had a calm, steady realization of what effects his invention would produce, and a firm faith in its universal application within its sphere of labor. What man, in so compact a form ever worked out grander and more admirable results toward the hastening of the day when many shall run to and fro, and *knowledge shall be increased* and *registered!*"

He died on the 19th of January, 1859, and no longer a possible refutation of the status of Morse before the world, the latter was not slow to avail himself of the opportunities thus presented to more strongly intrench himself in his ill-gotten position, and avoiding every opportunity of doing even the scant justice that his deceased friend and benefactor had so confidently believed he would, he seemed to lose all recollection of the deep obligations he had been and always would be under to Alfred Vail. No; I must except the occasions upon which, as a young man, I used to meet Morse at his own home or elsewhere, for he never then failed to mention to *me*, the obligations he was under to my father, and more than once, pointing to the line of foreign decorations fastened on the left breast of his coat, he has said: "These belong as much to your father as to me, and his family shall share in them." Morse died in 1872, and Alfred Vail's family have had no opportunity, *as yet*, to acknowledge the receipt of any of these jewels, not even that representing the

order of Nishan Ifftihar, and alleged to have been "presented" to Morse by the Sultan of Turkey, although there is a statement (contained in a pamphlet now in the possession of the library of the American Society of Civil Engineers), that to obtain the "presentation" of this decoration, Morse was willing to, and did, pay one hundred dollars.

Some time after the death of Alfred Vail, Morse was the recipient from certain governments of Europe of a present of the sum of 400,000 francs ($80,000), paid in lieu of patent rights, which it had been impossible to obtain there. Notwithstanding this money was presented to the *patentees* as a return for the great value the invention had proven to these countries, it was not until compelled, as the result of a suit at law, that Morse paid over to the other patentees their shares of the money. The following extracts from letters of the Hon. George Vail to the widow of Alfred Vail refer to this matter:

"FEB. 1, 1860.

"* * * Mr. Morse's conduct is singular. Alfred told me that we were to receive a share of the amount received from the Continental powers, and sure we ought, for at Prof. Morse's wish we gave away one half of our interest to secure to us the proceeds of one fourth of the sales to the Continent, and from that day to this neither of us have received a penny, and even now I am afraid that we are destined to go without. * * *

"* * * As regards that money received and to be received from the Continental States through France, Prof. Morse can hardly refuse conscientiously to divide with us. The reason is this: At the first agreement with Morse, Alfred and I bought of him one fourth of the whole interest. I advanced all the money and Alfred his time and talent, which was of great importance. After we had succeeded in bringing the matter of appropriating a sum sufficient for laying a wire between Baltimore and Washington before the Congress of United States, F. O. J. Smith and Mr. Morse entered into negotiations, and the result was Smith agreed to devote his time to the furthering of the introduction of telegraphy, to act as counsel and lawyer to us all, to pay expenses of his and Prof. Morse's trip to Europe, and to pay all expenses incurred in patenting Morse's telegraph there, and divers other things, for one fourth interest in the whole—the same as we had.

"Now Mr. Morse wished to retain a majority of the interest, still, in order to control the affair, and Alfred being anxious for a man of Smith's ability, agreed (and urged me to consent to the same) one half of our interest to Smith—so we and Morse paid equally for Smith's introduction.

"No patents were obtained in Europe, and instead of receiving any legal aid from him, we have spent, I think, and lost, $300,000 or $400,000 in lawing on his account, and having been induced by Morse to part with this one eighth of the whole, which had for its object the securing of the patents on the Continent, how can he now justly pronounce us unentitled to a portion of what is conscientiously yielded to him in lieu of a patent by those States in Europe. I wrote to him soon after his return from Europe—I have never received any reply. I am now awaiting the result. He told Alfred that we should be recipients of our share, as though it had been received as for patent rights. He is particularly jealous of any claim of merit in others as regards invention, and he thinks more of the preservation of his fame as inventor than of the money. It will not do to touch him upon that, if we would succeed in obtaining the share. The world will know Alfred's very meritorious connection with the telegraph. Col. Shaffner told me *that to Alfred belonged the credit of everything but the first inception*, and Alfred's book or work on telegraph is now in every public library in Europe, and indeed is the only standard work on that subject; always referred to by writers, and in courts where any discussion occurs on the subject of telegraphs, and no fear need be apprehended of his fame being forgotten. * * *"

One month previous to the day of his death, Morse, then confined to his bed, was visited, at his request, by the widow of Alfred Vail, who found him extremely annoyed by the perusal of the proof sheets of an article about to appear in a work published in Hartford, and in which his real status as the inventor of the telegraph and his treatment of Alfred Vail, and his part in the invention, was fully set forth. It may be interesting to state that this proof, which had been sent to the writer hereof, then in New Orleans, was *lost* there while in the possession of an editor of one of the local newspapers and found its way to New York and into Morse's possession.

Throughout that visit of Mrs. Vail to the sick man, which lasted some two hours or more, he continually asserted to her that "*the one thing I want to do now is justice to Mr. Vail.*" He went down to the grave, but his expressed intention of doing justice to the man he had wronged, has never, either by his direction, or at the hands of those he left behind, been shown to the memory of Alfred Vail, or by courtesy to any of his family, who, in fact, never expected that it would be.

Many will remember the occasion when, at the Academy of Music in this city, on the evening on the 10th of June, 1871, before an audience that filled the immense building, S. F. B. Morse, in whose honor this "reception" was given, made an address occupying an hour or two in the delivery. Would it have been too much to expect and believe that Morse (no matter how he had treated Alfred Vail alive and deceased, standing there before that audience and the world; because his remarks were to be telegraphed to all parts of the universe and upon this, perhaps the last time he would appear in public, for he was upon the verge of the grave), would have felt a desire to at least satisfy his own conscience and perform that act of justice to the name of his dead friend and partner that he had so long failed to do?

One would think that this was not too much to expect of this old man, but that confidence would have been misplaced. Did he do his old friend this simple act of justice? No. What he did say was only this, and as the writer was present and heard the words he uttered, and as they are matters of record, there can be no doubt of their authenticity, and can best be given in the words of a recent author:

HON. STEPHEN VAIL.

"After Mr. Vail's decease his rights were less recognized than ever before. So far as Prof. Morse's conduct could affect it, slowly but surely the star of his fame receded in the dim night of time. At length when the evening of Prof. Morse's long life had come, the evening of that bright day when his fame had crystallized itself, so to speak, into a rock-based statue, conspicuously located, where the sun might ever continue to shed its glorious rays upon the stalwart bronze—on that evening, in New York, when the telegraphists half way round the world were chanting the praises of Prof. Morse with their fingers on the instrument that Vail invented, and made to talk on a lightning-line-of-light, over mountains, hills and valleys, and through deep seas, from China to America—on that evening, when in the full-orbed splendor of his fame—at that hour, when many of those who were doing Prof. Morse honor were basking in the rays of the orb of day, then rising to the zenith of their heavens—what was it that Prof. Morse had to say of his old associate: 'Alfred Vail, of Morristown, N. J., with his father and brother, came to the help of the unclothed infant, and with their *funds* and *mechanical skill*, put it into a condition creditably to appear before the Congress of the Nation. To these New Jersey friends is due the first important aid in the progress of the invention.

"These are the quiet, subdued terms in which Prof. Morse was content to hand his co-inventor and early friend down to posterity. He made no allusion to Alfred Vail which would lead any one to suspect that he was anything more than a skillful mechanic; that Vail had ever done anything beyond putting into form the conceptions of Morse's brain. To say the least, it was an unhappy holding off from a magnanimous and generous course."

At a banquet given to Prof. Morse, at Delmonico's, upon the evening of Dec. 29, 1868, in his remarks concerning the invention of the telegraph, his generosity toward his old friend and co-partner were even of less significance of regard for Alfred Vail and the obligations due him, for all that Morse could find it in his heart to say of him was embodied in these few and ungrateful words:

"In 1835, according to the concurrent testimony of many witnesses, it lisped its first accents and automatically recorded them. It was a feeble child indeed, ungainly in its dress, stammering in its speech. It found a friend—an efficient friend—in Mr. Alfred Vail, of New Jersey, who, with his father and brother *furnished the means* to give the child a decent dress preparatory to its visit to the seat of government."

Many of those present upon these occasions and familiar with the facts, were astonished at the spectacle of this aged man, deliberately and premeditatedly making only this statement with reference to Alfred Vail.

"Furnished the means," was all that Morse could find to say of his friend—yes, more than friend and partner—the man who had made his name and fame at so great a cost to himself.

Further comment is unnecessary. But does not the willingness of Morse to falsify history, by inference as well as by assertion, in his claims for the patent, justify strong doubts in the claims he made for himself as the inventor of the telegraph, as the world only knows it, and correspondingly strengthen those made for Alfred Vail and others, which he (Morse) studiously ignored and refused to recognize?

In a biographical sketch of Professor Morse, by Mr. Frederick Brent Read, of Cincinnati, published in 1873, the writer stated without qualification, when alluding to the banquet at Delmonico's, and the scant mention made thereat to Alfred Vail, that, "it would have been more magnanimous if, in these last days of the aged savant, he had stated the precise facts and given Alfred Vail the full credit to which he was justly entitled. He would thus have generously raised a fitting monument to the memory of one who had years before 'been gathered to his fathers,' in the prime of manhood, who had, with wonderous modesty and singular reticence, refrained from claiming as his own invention, the improved 'Morse' instrument and alphabet."

Upon receipt of a request from the editors of The Electrical World to contribute an article to their series upon the invention of the telegraph, I accepted with pleasure, my intent only being to make such statements as facts at my command, relative to the invention, would permit, and avoiding all personalities. But this last resolve I have been compelled to ignore, as Mr. E. L. Morse and Mr. J. D. Reid, by their personal allusions to my father and myself, force me to notice them.

Consequently, I have no hesitancy in placing before the readers of these articles some facts of a personal character, concerning the late S. F. B. Morse, in his association with Alfred Vail and his family, which would otherwise have remained unmentioned.

I only beg an unbiased comparison of the scholarly and scientific argument made in this series, by the late and learned Mr. Franklin L. Pope, with the "inferences," "perhapses," "beliefs," what others "must have thought," misstatements, perversions of facts, omissions of dates, (to deceive as to the time letters were written by Alfred Vail), and other subterfuges, to say nothing of the personalities, of the veracious "historian," Mr. J. D. Reid, and the uninformed Mr. E. L. Morse.

The mention of the many incidents indicative of the ability and disposition of Morse to commit acts extremely inconsistent with the alleged high-minded and pure character with which his son and Mr. J. D. Reid would have the world believe *he was only imbued*, would require much more space than the limits of this article will permit. I cannot refrain, however, from mention of the treatment accorded a request (made under such conditions as are usually treated as commands), contained in a provision of the will of my father, wherein Morse was bequeathed certain telegraph apparatus connected with the early days of the invention, accompanied by the particular request, that he would, at once, present them to the Historical Society of New Jersey.

My father died on January 19, 1859, and Morse was very soon thereafter advised of the bequest as well as request. No attention whatever was given by him to the matter until (after repeated efforts had been made to obtain some recognition from him of his acceptance of this bequest), in 1870, *eleven years after*, he signified his receipt of the relics, as follows:

"New York, January 24, 1870.

"*My Dear Sir:*—Excuse my negligence in not apprizing you of the safe delivery of the box of articles left me by your father's will. It reached me in safety, *but is not yet opened*, owing to a peculiar press of engagements. Truly your friend and servant,

"J. Cummings Vail, Morristown, N. J. Samuel F. B. Morse."

This may have been a proper way of treating the memory of the man who had so loyally assisted him to the elevated position he was occupying, but by the family and friends of Alfred Vail, it was looked upon as the act of one consumed with egotism and embued with a desire for self-aggrandizement and fame, at no matter what expense of truth and justice. He did not wish to place on record anything that would in any way bring the name of Alfred Vail into public notice, and this view is sustained by his course after these relics had passed into his possession; for instead of paying the slight respect to the memory of his deceased friend, of carrying out his request concerning their final disposition, he handed them over to the Western Union Telegraph Company, by which organization, as if to further Morse's desires and intentions, they were relegated to the scrap heap!

Years afterward they were discovered by Mr. Franklin L. Pope, and by him placed with other articles, in a case, and publicly exhibited by that company, but within a few years past they have again disappeared from public view, and where they are I know not.

But a short time after the death of my father, Morse (in the light of after disclosures, anxious to lose no time in obliterating all important evidence of my father's connection with the invention of the telegraph), wrote me at Morristown, requesting that I send to him the book in which my father had had bound the letters he had received from Morse. Only a youth of 18, and with no thought but that these letters would be safe in the hands of my father's partner and supposed friend, I sent the book to him. Time passed on, but the book was not returned, nor was any attention given to my request, or to others sent later, until a peremptory demand for the return of the book was made, and it was then sent to me. I need not dilate upon the astonishment and anger that was evoked upon the discovery being made that letters and parts of letters written by Morse to my father, and having important bearing upon their connection as partners, had been abstracted from this book!

Later, when the papers and correspondence of my father were temporarily on deposit with the Historical Society of New Jersey, other letters were stolen, the care of these things having been of a very indifferent character. A few years since a daguerreotype of my father taken to a photographer in New York for the purpose of reproduction, was returned by him shortly after with the entire face scratched out, and so effectually as to leave no doubt that it was an intentional act. The photographer declared that it was done by some means which he was absolutely unable to explain.

My own efforts, extending over some months' time, to obtain from the possessor of Morse's copy of the agreement between my father and himself, a copy thereof, and which was promised me by the person referred to, have to this day been unsuccessful. Fortunately another means of obtaining a copy of the original document was disclosed to me, and the contract is embodied in this article. It would seem as if there had been and was a concerted and persistent effort (by whom the reader can judge to suit himself) to suppress, and if possible obliterate all evidence of the actual and important part Alfred Vail had in the invention of the telegraph.

(To be continued.)

A Municipal Arc Lighting Plant.

The electrician in charge of the arc lighting plant owned by the city of Newark, O., gives in his report for the year ending June 12, 1895, the following itemized account of operating expenses:

	Dr.	Cr.
Coal account	$739.13	
Carbons	942.86	54.00
Oil	146.41	37.15
Labor	102.94	
Drayage	22.05	
Waste	33.49	5.44
Freight	857.29	
Sundries	312.61	152.00
Salaries	4,235.70	
Stationery	21.84	10.00
Inspection of plant	228.10	
Supplies	115.23	46.25
Packing	45.97	14.50
Expressage	22.25	
Hardware	71.46	34.46
Furniture	32.50	26.00
Taking up main belt	18 60	
Lamp repairs	86.24	64.20
Dynamo repairs	24.48	22.93
Engine repairs	18.78	14.53
Boiler repairs	12.38	
Dynamo supplies	52.49	30.52
Lamp supplies, including four arc lamps	278.87	228.83
Line supplies	149.79	122 92
Engine supplies	18.70	13.86
Boiler supplies	10.73	6.00
Total expense and Cr	$8,600 89	$882.85
The credits are from an invoice taken June 12, 1895	882.85	
Actual operating expense	$7,718.04	
Interest on $40,000.00 bonds at 5 per cent. 1 year	2.000.00	
	$9,718.04	

There are two hundred arc lamps, in use from dusk to daybreak.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

DYNAMOS, MOTORS AND TRANSFORMERS.

Heating of Dynamos.—The Lond. "Elec.," Oct. 11, contains an article on this subject by Mr. Wilson, in which he gives the results of some experiments and discusses some points in connection with the heating of dynamos. There are four causes for the generation of heat in the armature, namely, the armature current, magnetic hysteresis, induced currents in the iron and induced (eddy) currents in the armature conductors; the first is easily calculated as also the second; to measure the second, third and fourth he gives the results of tests in which two machines were coupled together, one running as a motor at varying speeds, the power for which could be measured, while on the other the brushes were set on the neutral line and connected to a volt-meter, the excitation being varied at will; first the generator was not excited and the power noted, it was then excited, the difference between the two powers being then a measure of the energy lost in the last three causes of heat. He discusses the possibility of pre-determining the losses in an armature, by pre-determining curves such as those obtained in this test; having given a suitable relation between total watts dissipated, the radiating surface and the circumferential velocity, one could thus predict the ultimate temperature; this is discussed with the aid of a number of curves giving the relation between these quantities. and by working backwards the results were found to differ from those obtained by experiment, the probable reasons for which, being given; unless the plates are perfectly insulated and the relations for hysteresis and induced currents are known for the particular iron, the problem is complicated. A careful experiment showed that the first curves referred to are not sensibly changed by a rise of 42° F in temperature. In another experiment a current was passed through an armature at rest, in series with a similar one in motion and the heating in both was measured, the results being given in a table. He finds a difference between the temperatures taken with a thermometer and those obtained from a measurement of the resistance; the temperature varies at different parts of the surface, the commutator and its connections having a cooling effect; in the stationary armature there was a difference between the commutator end and the other end of about 5° F, while in the movable armature it was 9° F; thermometers with small thermo capacity should be used; he found that after about six hours the temperature is fairly constant, but this evidently depends on the size of the machine. (The author's style is somewhat disconnected and his statements are sometimes not clear but some of the data given is of interest).

Compounding Dynamos by Armature Reaction.—In the Lond. "Elec. Rev." Oct. 11, Mr. Sayers replies to the recent criticism of Prof. Elihu Thomson (see Digest, last week). He believes that the loss due to the resistance of the windings and the brush contact, is apparently the main cause of breaking down in Thomson's experiments; he thought Thomson did not bring out clearly the point that after a certain load is reached the armature reaction in his arrangement does not tend to increase the effective flux, but to diminish it. He quotes Thomson as saying that when carbon brushes were used they could be set back from their maximum position even at heavy loads and that this movement was attended with little if any increase of sparking, while the potential steadily went down; Sayers accounts for the sparking remaining the same on the supposition that the fall of voltage and consequently of current was sufficient to account for it; degrees of sparking moreover are difficult to observe when carbon brushes are used. In experimenting with one of his machines, Sayers found that inductive commutation was quite essential to the machine being self-exciting without windings on the magnets or, in other words, if the brushes are shifted either way, bringing the commutating coils out of position relatively to the pole tip, the excitation failed; when the brushes were shifted backwards, as described by Thomson, there would be no inductive commutation; the current in the armature section and not the brushes, would remain unchanged until the preceding section was almost out of contact with the brush, when it would suddenly reverse, a process involving considerable waste of energy, and in armatures of large self-induction the cumulative effect of this supplies the explanation of the results observed by Thomson and himself.

Inert Dynamo Magnets.—Sir David Salomons in a communication to the Lond. "Elec.," Oct. 11, describes a case in which, on starting to charge accumulators from a dynamo, it was found that the magnets were absolutely inert and no E. M. F. could be produced; he considers the occurrence as a very remarkable one as the iron was very soft and weighed probably over one ton and had been in use during 8 years; he suggests that magnetic earth storms might have been the cause; as such an occurrence is possible, though rare, he suggests as a simple remedy the use of a flat piece of hard steel placed at the sides of the iron core; (would not the lines of force from these permanent magnets, be short-circuited by the soft iron next to them and thus defeat their purpose?) Editorially it is suggested that if the machine was shunt-wound it is possible that the effect was due to starting on such a low resistance that the shunt coil was practically short-circuited, a hypothesis which is preferred to that of the magnetic earth storms.

Theory of Alternating-Current Motors.—In the "Elek. Zeit.," Oct. 10, Prof. Arnold states that Prof. Blondel claimed, with Ferraris, to have been the first to show that a non-synchronous, single-phase motor, in regard to the power delivered, is the equivalent of a system of two 3-phase motors on the same shaft, the fields of which revolve in opposite directions. Arnold claims to have shown this in an article in the beginning of the year, 1894, (which was published in THE ELEC. WORLD about that time); he gives a brief summary of the theory.

Some General Properties of Rotary Magnetic Fields.—A long article by Prof. Blondel, forming the first part of an article on this subject, is published in "L'Eclairage Elec.," Aug. 10; he limits himself to fields in multipolar motors; in the present portion the results are not given in a form to admit of being abstracted.

Photoelectric Cell.—An illustration of the one used by Prof. Minchen, for the electrical measurement of starlight, referred to in the Digest, June 29, is illustrated in the "Eng. Mag." for October.

Behavior of the Carbon Brush on Power Generators.—The "Sibley Jour." for October contains a short article by Prof. Ryan, in which he gives an explanation of the action of the carbon brush on power generators. In dynamos for incandescent lighting the self-induction of the armature coils is small, the air gaps large and the M. M. F. of the field easily maintained greater than the maximum of the armature, and under these circumstances it was easy to maintain suitable conditions for the successful commutation of the currents by means of metallic brushes furthermore the load fluctuates slowly. But when power generators came into use it was found that such a method of current commutation was utterly unsuited and it was then that Vanderpole suggested the use of carbon brushes which were found to be a great success; he thinks that a far greater part, than people have thought, of the success of the electric street railway, has been due to the use of carbon brushes on the generators and motors; the load changes so suddenly that no adjustment is possible and it is therefore of interest to see in what way the brushes take off the current, making their movement unnecessary, to avoid sparking. The self-induction E. M. F. formed by the sudden reversal of the current in such coils is high and some sort of E. M. F. must be available to oppose this with a balance sufficient to reverse the current against the ohmic resistance; there is no aid of the E. M. F. generated in the fringe of the leading pole tips. Supposing that the brush completely covers one commutator bar and partially covers the two neighboring ones, the restraint area of contact of one of the latter, presents considerable resistance to the passage of the total current from one side of the armature, and this gives rise to a considerable local fall of potential, which diverts a considerable portion of the current through one of the two coils which are short-circuited, and as the entire surface of the bar connected to the other end of that coil is under the brushes, there is therefore less constant resistance. To explain the tendency to reverse the current he applies a similar argument; there is a restricted area of contact constantly diminishing with increasing resistance, so that just before a bar comes completely under the brush a high local fall of potential occurs, which causes some of the total armature voltage to divert the current by way of the neighboring coil against the current already in that coil, causing it to reverse quickly in opposition to the E. M. F. of self-induction. In this way the high specific resistance of carbon is used advantageously for effecting commutation without the aid of the pole fringe E. M. Fs.; it cannot be depended upon for complete commutation, but in most generators with armatures of the iron-clad type, fully half of the current may be thus commutated; in street railway generators it is usual to adjust the brush at no load so that it is in the neighborhood of the magnetic fringe of the leading pole tip, where the E. M. Fs. mechanically generated are sufficient to reverse one half of the normal current; these E. M. Fs. are not sufficient to cause serious short circuiting of the coils under commutation under no load and assist the carbon brushes; it is in this way that generators are now made sparkless under the most trying conditions.

Armature Design.—The "Sibley Jour." for October reprints in full the communication from Mr. Parshall, which was abstracted in the Digest, July 12, and in which he comments on the paper of Prof. Ryan on armature ventilation, which was abstracted in the Digest, Sept. 7.

POWER AND HEAT.

Distribution of Power in Collieries.—The Lond. "Elec. Rev.," Oct. 11, reprints a paper by Mr. Atkinson. It is intended more for mining engineers and contains little of novelty for electrical engineers; he shows how the fuel expenditure per ton of coal raised may be decreased by generating all the power in one engine or pair of engines and distributing it electrically; he shows that the advantage and economy is so great that a revision of the present method must take place. Regarding compressed air he states that the pipes must be free from leakage and that the air must be heated before being used, two conditions which cannot be realized in practice, the advantages in first cost and efficiency therefore remaining with electricity. He states that it has been shown from theoretical considerations and from practical tests that the sparking at a good electric motor is unable to ignite firedamp owing to the fact that the temperature is not sufficiently high and there is danger therefore only under abnormal circumstances such as when a brush falls out of its holder; he knows of no recorded instance where there has been an accident from the use of an electric motor in a coal mine; he points out the advantages of multiphase motors. Regarding the danger due to rupture of the cables, he mentions experiments which were accepted as conclusive by the Prussian Fire Damp Commission, and which showed "that even violent sparks from the rupture of the current accompanied by the explosion of fragments of iron in a state of combustion, had no effect on the inflammation of firedamp" (quoted from the "Colliery Guardian," Feb. 20, 1891); according to Prof. Lewis the ignition of firedamp in most cases is not the raising of the temperature to the point of ignition, which is very high, but by the raising of it to the point of its decomposition with evolution of hydrogen, which becoming ignited eventually ignites the firedamp; this requires about ten seconds in time and the maintaining of a particular mass of gas in contact where the heat is developed long enough to effect the operation; neither at the commutator nor at the point of rupture of the cable are these conditions fulfilled; in the face of the facts, experiments and experience now at one's disposal, those who raise the objection to electricity on the ground of safety, ought to bring some proofs of the danger; notwithstanding the extended use of electricity these causes of accidents do not occur, and in the opinion of many well qualified authorities the danger is less than that arising from safety lamps. He considers that power distribution by electricity may now be used with confidence for the whole of the power required at a colliery; in conclusion he gives a brief description of the fundamental principles of multiphase motors.

Comparative Cost of Energy in Central and Private Plants.—The reprint of the article by Prof. Zickler (see Digest, Oct. 19,) is concluded in "L'Elec.," Oct. 5; he discusses at some length the question of whether it is cheaper to use an independent engine or to use an electric motor taking current from central stations, and shows how the conditions may be represented in the form of curves.

Rock Drills.—In the conclusion of the long article by Mr. Meissner (see Digest, Sept. 14 and Oct. 5) in the "Elek. Zeit.," Oct. 3, he describes the multiphase system of motors of the firm of Siemens & Halske; the motor itself is in a portable box and is connected to the drill by means of a flexible shaft. He shows that for the same effective output the amount of heat developed in an alternating-current motor is just double that in a continuous-current motor, and one of the important points in such machinery therefore is to prevent the heat which is developed in the box, from doing damage; to avoid the possibility of reversing the current and therefore the direction of rotation of all the motors, a convenient form of switch was devised, rendering it impossible to make the incorrect connections.

LIGHTS AND LIGHTING.

Comparisons of the Acetylene and the Arc Light.—A translation of that portion of the paper by Mr. Wedding (see Digest, Sept. 28) which refers to acetylene and the arc light, is given in the Lond. "Elec.," Oct. 11.

Etheric Lighting System.—The "Elec. Eng.," Oct. 23, publishes a number of the illustrations, accompanied by a brief description, of the patents just issued to Mr. Moore for the protection of what he calls "etheric" lighting. The fundamental principle "consists in generating electric waves or vibrations suitable for producing luminous effects by interrupting the flow of electric current through a circuit of induction in a high vacuum as contra-distinguished from a partial vacuum or one in which the rarefaction has not been carried beyond the point suitable for exhibiting luminous effects. The electric waves of vibration so generated are made to produce luminous effects by action upon a receiver containing a rarefied gas." In order to produce such a phosphorescent light, it is said that a high E. M. F. with a short wave length is required; in obtaining such an E. M. F. by breaking a circuit of high induction, considerable depends on the suddenness of the interruption; in this system the hammer of the interrupter and the contact are placed inside of a vacuum tube which has been exhausted to the very highest degree obtainable, while the magnet which acts on the hammer is placed outside of the tube; in this tube there is no air resistance and it was found that the number of vibrations of the interrupter was 4 to 5 thousand per minute or about 3 to 4 times as fast as it would vibrate in the air; the interrupted current is passed through another vacuum tube, which has been carried to a comparatively low degree of exhaustion best suited for producing the maximum light; the terminals of these tubes are coated with metallic paint and the wires are attached to these coatings. Another figure shows lamps containing filaments, which it is stated can also be operated with good results. With this apparatus "an ordinary 110-volt current with an exceedingly small amount of inexpensive apparatus, can be transformed into the etheric light."

TRACTION.

Electric Carriage.—Quite a full technical description of the Jeantaud carriage, which took part in the Paris-Bordeaux road races, is given in "L'Elec." Oct. 12; the following are the chief technical data given: The Fulmen accumulators were found to be the best of all those tried; they weigh complete, 1,870 pounds, and consist of 38 cells in 12 boxes of 3 to 4 cells each; each cell contains 33 pounds of plates and has a capacity of 300 ampere-hours, the normal discharge lasting 10 hours; at the rate of 5 amperes per klg of plates the capacity is 210 ampere-hours. The carriage will seat 6 passengers, and the total weight is 7,040 pounds; the commercial efficiency of the motor is exceptionally high, being at times as much as 92.5 per cent., at about its normal output of about 7 hp corresponding to an output of 70 amperes at which rate the carriage runs at a speed of 24 km per hour on a level; the motor can develop 14 to 15 hp without any sparking at the brushes; the motor is used as a dynamo in place of the brake and the reverse current will sometimes reach 80 amperes but the quantity recovered is said to be too small to be of any importance; the controller, by means of which the batteries are grouped differently, sometimes cuts out a group of cells and the discharge is therefore not the same for all of the cells, which is a disadvantage of that arrangement; the current will sometimes be as great as 200 amperes; a single charge will suffice for a trip of 24 to 42 miles; to change the boxes of cells requires 10 minutes.

Bristol.—A long, profusely illustrated description of this line, which was constructed by the British Thomson-Houston Company, is published in the Lond. "Elec. Rev." Oct. 11.

Municipal Ownership of Street Railways.—In a short article by Mr. Bemis in "Elec. Power" for November he advances some arguments in favor of municipal ownership. He makes a distinction between the immediate and more remote results of such ownership; with the present "municipal rottenness," it is natural to shrink from any increase of public functions, but more remote results would be a greater popular interest in the purification of the government; a prominent street car director of Philadelphia was quoted as having stated that the private companies have been spending half a million dollars a year to control city councils; the corrupt relations between the city councils and the monopolies in Chicago are admitted by all; he believes it much easier to secure a reform in civil service than in the relations between municipal governments and private monopolies and that crookedness in municipal work is not nearly as bad as that which exists between city councils and private monopolies. He enumerates other reasons for public management, among which he states that public ownership means higher wages, less expenses for attorneys, advertising and boodle; as about 200 cities already own their electric lighting plants and the number is increasing there is a chance of saving in combining the various municipal undertakings; cities can borrow at 3 to 4.5 per cent. while private companies pay 5 to 6 per cent.; private street-car companies often make 15 and sometimes 25 per cent. on the honest cost of construction; cities can get special rates on materials; public-owned works can be paid for within 20 years after which there is no reason for earning profits or interest, which renders low rates possible; when honestly managed public ownership frees us of the great danger which now confronts us when private monopolies control public opinion through a subsidized press and the placing of stock among prominent citizens. What is most clearly needed is the granting of franchises, which enables the city to buy the plant after some years or to release it, but he does not believe this plan to be equal in the long run to that resulting from complete city management. The only good test of the possibilities of public ownership under honest service is offered by European and Australian cities, the results of some of which he enumerates, mentioning also the Brooklyn Bridge line, and remarking that there are few if any private companies who would voluntarily reduce fares as this public company has done. In conclusion he thinks it easier and wiser to try city ownership of street car lines on a large scale only after we have gone further with city ownership of gas and electric light plants and have gained administrative experience.

In an article following this, by Mr. Foster, he takes somewhat the opposite view. He thinks that the most strongly urged argument against private ownership is that those companies are making too much money, and he seems to consider it perfectly proper that they should do so; the municipalities consider the subject only after a company has taken all the risks and made a success of the work; he considers that owing to the "great distance" between here and Europe "it is of course utterly impossible to obtain evidence" against a "supposed success" of municipal ownership abroad; he thinks success is within the limits of possibility in foreign and some few cities in the United States, as, for instance, in New

England; he considers the "human make-up of this country" different from most others, a matter which he does not think is trivial; he recommends changing the present system and disposing of franchises by putting them up at auction to the lowest bidder in fare for the passenger, and then let the franchises be exclusive and perpetual, believing that the investors would then be satisfied with low rates of interest; if a lump sum is paid as usual or an annual charge, it only goes to decrease the taxes of the few while those who ride on the cars get no benefit. He specially emphasizes the point that municipal supervision of private corporations in quasi-public work is for the best interests of all and when franchises are sold for the benefit of the public and not for the heavy tax payers then only shall we have municipal work done on a really cheap and proper basis.

In an editorial by Mr. Osterberg he expresses disagreement with the latter article and quotes figures regarding the Manhattan Elevated and the New York Central railways, showing that if bought by the government it would be possible to reduce the fares and rates very materially in a comparatively short time.

A Plea for Electric Railways—"Elec. Eng'ing" for October contains a long article with this title, by Mr. Abbott, in which he gives some statistics for the United States, Canada and Europe and discusses the subject from the standpoint of the company or the investor; some of the statistics are reduced to the form of curves of some interest; he discusses the mutual relations which should exist between the companies and the municipal or State authorities.

Electric Cars on Steam Railways.—Mr. Knight in the "Eng. News," Oct. 24, calls attention to a short line between Pottsville and Minersville, Pa., about 5 miles in length, where both steam and electric trains are run together at regular intervals; the electric cars are long and are carried on two four-wheel trucks and contain a baggage compartment.

Development of the Electric Locomotive.—An illustrated historical summary is given by Mr. McGhie in "Elec. Power" for November.

Metropolitan Elevated R. R. in Chicago.—Some of the electrical details of this road are described and illustrated by Mr. Hazelton in "Elec. Power" for November.

Combination Summer and Winter Car.—An illustrated description of a car to be used in Pittsburg is given in "Eng. News," Oct. 24.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Stafford.—Almost the entire issue of the Lond. "Elec. Eng." Oct. 11, is devoted to a a well-illustrated description of this station. The plant is on the same site as the gas works but the power is obtained from steam; a continuous-current, three-wire system is used in conjunction with accumulators; to meet the increased demand of the future it is proposed to erect accumulator sub-stations, charging them from the main station.

La Goule Transmission Plant.—A translation of the article mentioned in the Digest, Aug. 31, is published with the illustrations in the Lond. "Elec.," Oct. 11.

Electrical Equipment of Modern Office Buildings.—In "Elec. Power" for November Mr. Sachs gives a long illustrated description of the systems, including details, used in large office buildings for both lighting and power purposes.

WIRES, WIRING AND CONDUITS.

Rules and Regulations for Indoor Installation.—An abstract of the Paris Municipal regulations, more in detail than the one mentioned in the Digest recently, is given in the Lond. "Elec. Eng.," Oct. 11.

Construction of Telegraph Lines.—"Eng. News," Oct. 24, publishes the revised rules for line construction recently issued by the Western division of the Western Union Telegraph Company.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetization of Iron.—The "Zeit. f. Elek." Oct. 1, contains a long article by Prof. Zickler in which he shows how some of the magnetization curves may be represented by means of formulas, and how one of these curves may be constructed graphically when the co-ordinates of one point are given accurately; these curves and formulas are sufficiently accurate for practical purposes. Besides the usual quantities $\mathfrak{B}$, $\mathfrak{H}$ and μ, he uses a quantity which he calls specific magnetism or magnetism of a unit volumn of iron, representing it by S and another which he calls a co-efficient of magnetization or magnetization function which he represents by k; the relations between these are

$$k = \frac{S}{\mathfrak{H}}$$

which gives

$$\mathfrak{B} = 4\pi S + \mathfrak{H}$$

and

$$\mu = 4\pi k + 1.$$

There is another way of considering the quantities $\mathfrak{B}$ and μ. Imagine that the iron could be rapidly withdrawn from the magnetizing coil, then the number of lines per unit cross-section which have been made to disappear, is no longer represented by the above equation, but by

$$\mathfrak{B} = 4\pi S$$

as those generated by the coil still remain; analogously the formula for permeability will then be

$$\mu = 4\pi k.$$

According to this method, suggested by Bosnaquet the values $\mathfrak{B}$ and S, as also μ and k, differ only by the factor for 4π; for complete saturation, that is for the maximum of magnetization or the maximum of specific magnetism S one obtains

$$\mathfrak{B}_m = 4\pi S_m;$$

that is, $\mathfrak{B}$ approaches a finite value, $\mathfrak{B}_m$, and for this maximum the limiting value of μ is not unity but zero. Instead of using the usual curve, in which the induction is represented as a function of the magnetization, he prefers the curve giving the relation between the permeability and the induction as this curve possesses the property of having a finite maximum, which has an important physical meaning, as it determines the most favorable case in the process of magnetization; that is, in this case a unit line generates the largest number of lines per unit of area. This curve starts like the usual one, reaches a maximum, and then falls again toward the horizontal axis, passes through a point of inflection and finally intersects that axle, as it is necessary to assume that for the maximum induction the permeability is zero. In order to determine the properties of this curve, he made a large number of experiments with closed iron rings, the results of which showed that the maximum induction is equal to three times that at which the permeability is a maximum, and the abscissa of the inflection point to equal to two thirds of this; it follows that the degree of saturation when the permeability is a maximum is equal to one third, and this represents the most favorable case in the process of magnetization. He finds that this curve may be represented algebraically by an equation of the third degree, in which he deduces and in which he assumes that the initial value of the permeability is equal to $\frac{1}{10}$ of the maximum; the equation for the permeability is as follows:

$$\mu = \mu_0 \left[\frac{1}{10} + \frac{31}{15}\left(\frac{\mathfrak{B}}{\mathfrak{B}_0}\right) - \frac{21}{15}\left(\frac{\mathfrak{B}}{\mathfrak{B}_0}\right)^2 + \frac{7}{30}\left(\frac{\mathfrak{B}}{\mathfrak{B}_0}\right)^3 \right]$$

in which μ_0 represents the maximum permeability and $\mathfrak{B}_0$ the induction at this maximum permeability. He tested this equation by comparing the values with those obtained from a large number of experiments made with iron rings of different materials, dimensions, and by different observers, and finds that they agree very well, as shown in a table of values, the agreement being sufficient for most practical purposes and would doubtless have been better if the values at the maximum permeability had been determined more accurately; it has an advantage over other formulas, that its application is not confined to any limiting values. One third of the maximum induction may be substituted for the quantity $\mathfrak{B}_0$ giving a formula in which the value of the degree of saturation can be readily introduced; by substituting for the permeability the quotient of the induction and the magnetizing force; and representing by $\mathfrak{B}_0$ the induction at the maximum permeability, he obtains the formula

$$\mathfrak{H} = \mathfrak{H}_0 \frac{\frac{\mathfrak{B}}{\mathfrak{B}_0}}{m}$$

in which m represents the quantity in brackets in the formula given above for the permeability; this is the formula which would be most generally used in practice; in this also the degree of saturation can be readily substituted for the quotients of the inductions. He then shows how such curves may be constructed graphically by means of three parts of different parabolas, the results being sufficiently accurate for practical purposes. The only thing necessary to know in order to use the formula is the value of the maximum permeability of the induction at this point in terms of the maximum induction. Strictly speaking, the theory is based on so-called elementary rings, that is, such whose cross-section is very small as compared with their diameters; with such rings there will be definite values of the maximum permeability with a definite maximum induction, and numerous researches with such rings of the same dimensions and of different materials will give the relations between these two values.

General Relation Between Electric and Magnetic Force.—A short descriptive note of Prof. Pupin's paper, read before the Amer. Assoc. for the Adv. of Sci. on "The Most General Relation Between Electric and Magnetic Forces and Their Displacements," is published in "El'ty," Oct. 23.

Elements of Complex Quantities and Vectors.—Mr. Dommerque's mathematical article is continued in "Elec. Eng'ing" for October.

Flow of Alternating Current in an Electric Cable.—A short note mentioning Prof. Pupin's paper on this subject, read before the Amer. Assoc. for the Adv. of Sci., is published in "El'ty," Oct. 23.

ELECTRO-CHEMISTRY AND BATTERIES.

Improvement in Accumulators.—A paper by Dr. Sieg recently read before a Cologne society, is abstracted briefly in the Lond. "Elec.," Oct. 11. He refers to the new form of Hagen accumulator (see Digest, Sept. 14); difficulties arising in casting the grid have been overcome by the use

of an improved mould; the plates are kept apart in the accumulator by corrugated, perforated, celluloid separators which offer great resistance to the lateral pressure; the cells are formed of hardened lead and are closed with soldered covers; these cells are used for traction and train lighting purposes; on the Marienburg railway where they are used for lighting, each car contains 8 cells of 108 ampere-hours, at 28 amperes maximum discharging current; the charging current is 18 amperes and the weight 374 pounds. The special features of these cells is claimed to be the high rate of charging, as they may be charged in 6 hours. The question of whether accumulators can be over-discharged for a short time without injury, was made the subject of very severe tests and he concludes that accumulators which are subject to great strains should not be discharged beyond the guaranteed performance, which is about two thirds of their capacity; there is no objection to a short discharging at a high rate, providing it does not affect the limit of discharge, as it is the too prolonged discharge which is especially injurious, since the sulphating which then takes is the cause of the buckling, especially when a too long continued discharge is not immediately followed by a charge. The results were confirmed also by another series of tests, which are described briefly.

Production of Pure Zinc.—An article by Messrs. Mylius and Fromm from a German chemical paper is abstracted in the "Electrochem. Zeit." for October. To try to purify zinc by dry methods, lead to no favorable results; the wet process can be carried out only with the aid of electrolysis and this can be done in two ways, by the deposition of the metals from purified solutions with insoluble anodes, or by electrolytic refining with the use of soluble anodes of zinc. In their researches they used pure solutions of sulphate of zinc and obtained the following results: the pure zinc of commerce contains in all cases noticeable quantities of cadmium, lead and iron; a solution of sulphate of zinc can be purified electrolytically so that chemical analysis cannot find any heavy foreign metals; zinc oxide is easily obtained by a chemical process, with the same purity; the electrolytic zinc obtained from zinc sulphate or oxide, contains appreciable quantities of platinum which comes from the anode; the purest zinc is obtained by the repeated electrolytic reduction of the metal in basic zinc sulphate solutions from which it is obtained in a spongy state and must be melted in vacuum; the metal so obtained is not absolutely pure but contains at least 99.99 per cent. of zinc; with the electrolytic decomposition of zinc the secondary decomposition of water cannot be prevented entirely; the formation of spongy zinc takes place by the action of the oxygen.

Theory of the Galvanic Cell.—The "Elektrochem. Zeit." for October contains a long article by Mr. Schmitz-Dumont on "The Theory of the Galvanic Cell in Connection with the Theory of the Electric Wave." He endeavors to give an idea of the mechanical movements in a galvanic cell in the light of the new theories of electrical oscillations.

Aluminum Plant at Niagara Falls.—According to the "Eng. News," Oct. 24, the Pittsburg Reduction Company has just placed a contract for 4,500 hp with the Niagara Falls Hydraulic Power & Manufacturing Company, whose plant is located at the edge of the cliff about half a mile below the falls, the water for which is provided by a canal; the turbines will be operated under a head of 210 feet, which is probably the highest head that has ever been used for turbine wheels of the ordinary American pattern; the power-house with the generators will be on the bank of the river at the bottom of the cliff and the current will be carried up by cable to the top of the cliff to the reduction pots. Westinghouse generators will be used and will be shunt-wound, revolving at 250 revolutions and flexibly coupled with the turbines; they are required to run at full load for a week with a rise of temperature not over 40° C., and the brush capacity will not be less than 50 amperes per square inch of brush; they must not spark under a change of load of 33.3 per cent. and are capable of being speeded up to 500 revolutions without injury; the "efficiency" (but what efficiency, is not stated) when fully loaded is 94 per cent.

Disinfecting Plant.—A short, illustrated description of the Woolf plant in Philadelphia is published in the "Elec. Eng.," Oct. 23. It has a capacity of 500 gallons every three hours; the current is taken from the 110-volt lighting circuit of the City Hall and reduced down to 6 volts by a motor generator having a capacity of 1,000 amperes; 2 tanks of 700 gallons each are used; the positive electrodes are made of copper coated with platinum. The liquid is pumped into a cart outside of the building, from which it is distributed to wherever it is required; it is intended to disinfect the overground drainage in the thickly populated parts of Philadelphia and will also be used for special cases of domestic disinfection by the Board of Health.

New Primary Battery.—"El'ty," Oct. 23, publishes a translation of the article by Mr. Morisot, describing his new cell, a short description of which was given in the Digest, Sept. 14.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Standards of Light.—The "Elek. Zeit.," Oct. 10, contains a paper by Dr. Liebenthal in the form of a contribution from the "Reichsanstalt" on "The Dependence of the Hefner and Pentane Lamps on the Constitution of the Surrounding Air," an abstract of which was given in the Digest, Aug. 24; the following additional information may be of interest. Previous extended researches at that Institution have shown that if properly used and when burning in the same air, the Hefner lamps have the same candle-power; the same was shown to be the case with other lamps of this kind examined since then; there remained to be determined in how far the candle-power depended on the constitution of the surrounding air; the experiments to determine this are described in the paper and the results given; similar results are also given for the Pentane lamp; as a source of comparison a number of constant electric incandescent lamps were used. Regarding first the moisture in the air, it was noticed that the candle-power of the Hefner lamp varied considerably during the year, and this was found to be due to the moisture in the air; a table of the mean values for each month of the year is given, as also the humidity at the time. The total variation in the year was 8.5 per cent. It was found that the candle-power may, with sufficient approximation, be expressed as a linear function of the humidity, the equation for which was given in our previous abstract; the candle-power diminishes regularly with an increase in the humidity, by about 0.55 per cent. for every liter of water; the mean difference between the calculated and the observed results is 0.41 per cent. He concludes that for nearly all practical purposes this correction need not be taken into consideration, but for accurate work it must be considered and therefore it must be decided to call its value unity for a mean humidity corresponding to 8.8 liters of water per cubic metre of dry air, this being therefore the accurate definition of this lamp; he shows how the vapor tension may be substituted in the formula and gives a very useful table of values of the Hefner lamp for each of a number of temperatures and relative humidities expressed in per cent. Regarding the dependence on the barometric pressure it was found that the variations were but slight, the difference due to any given barometric pressure having been given in our previous abstract. Regarding the effect of carbonic-acid gas, he gives the formula which was given in our previous abstract, and concludes that the effect of this gas is of less importance than that of the humidity as the variation in its amount is not great; in a freshly aired photometric room the amount of carbonic-acid gas varied between 0.62 and 0.93 liters corresponding to a difference of 0.2 per cent. in the candle-power, which is within the limits of the errors of observation; in a well-ventilated room therefore this effect may be neglected, but in small, close rooms appreciable errors may arise. Regarding the Pentane lamp, he gives an illustrated description, remarking that there is considerable variation in the candle-power when the top of the flame is at the top, bottom or middle of the sight hole, the relative variation being least when the point of the flame is in the middle of the opening and that was therefore taken as the normal position. Owing to the heating of the lamp it takes about 30 minutes after it is lit, until its value remains constant; at first the flame continues to increase in length requiring continual adjustment; the lamp should not be used until it has arrived at this constant value and even then it can only be left for a short time without readjustment; in this lamp the centre from which distances are to be measured is not the axis of the flame but a point half way between the centre and the side (this is not quite clear in the description); the correction factor is given. The formula for the effect of moisture was given before, the candle-power being given in Hefner lamp units; for every liter the change is about 0.6 per cent., or only slightly more than that of the Hefner lamp. He finds that the Pentane lamp used had a candle-power 2.6 per cent. greater than the English standard candle, if the variation between that candle and the Hefner lamp is taken as 1.14 and value obtained as a mean of a large number of measurements made at that institution. Regarding the effect of the barometric pressure, the formula for which was given before, he concludes that in making measurements with this lamp the height of the place of observation above the sea must be considered (no corrections for temperature are given for either lamp). In conclusion he states that from the researches made at that institution it follows that the Hefner lamp is decidedly preferable to the Pentane lamp; (in this he differs from the statement made in an article abstracted in the Digest, Oct. 12).

Vibration Galvanometer.—A paper by Mr. Rubens from the "Wied. Ann.," No. 9, is abstracted briefly in the Lond. "Elec.," Oct. 11; it is intended for measuring alternating-currents and is claimed to be more sensitive than the dynomometer or the thermo-voltameter and more readily used than Wien's optical telephone, on which the present instrument is based. "An armature of soft iron wires is attached to a stretched wire, and is set into torsional vibration by an alternate-current traversing four tungsten electromagnets suitably arranged. The amplitude of the vibration is a maximum when its period is the same as that of the current, and this maximum is proportional to the strength of the current. It is attained by altering the length of the tension of the wire. A bright slit viewed in a small mirror attached to the wire appears as a luminous rectangle, whose breadth measures the amplitude."

Rowland Reflecting Galvanometer.—A brief, illustrated description of a form devised by Prof. Rowland of Baltimore, and made by Elliott Bros., of London, is published in the Lond. "Elec.," Oct. 11.

Preventing Vibration of Instruments.—A paper on ground vibration from the "Wied. Ann.," No. 9, is briefly abstracted in the Lond. "Elec.," Oct. 11. Prof. Einthoven supports his capillary electrometer on an iron slab weighing about 3 cwt., which floats on a film of mercury 1 mm thick, and obtained excellent results. Mr. Julius suspends a table by three long vertical wires attached to the vertices of an equilateral triangle, the instrument being placed on this table, the centre of gravitation being lowered by an adjustable weight under the table.

Manganene Resistance Coils.—Results of tests made with two B. A. units, made of the manganene of Dr. Lindek, is given by Mr. Walker in the Lond. "Elec.," Oct. 11. The proportions were 73 per cent. of copper, 3 of nickle and 24 of manganese; the wire was not annealed; it appears from the results that the coils seemed to increase in resistance with temperature and therefore do not acquire at a critical temperature, a negative temperature co-efficient above and a positive one below that temperature, as some experimenters have found; the temperature co-efficient is remarkably low. The tests are briefly described; one coil has an average temperature co-efficient of 0.000011 and the other 0.00004. He concludes that these coils have properties differing from most others of manganene and if they can be imitated, some valuable units may be made available.

Regulating Resistance.—The one used by the Board of Trade standardizing laboratory for regulating from 60 to 5,000 amperes, and forming the smallest resistance yet made, is illustrated and described in the Lond. "Elec. Rev.," Oct. 11. It consists of three tubes through which water circulates to carry away the heat produced by the current whose density is about 30,000 amperes per sq. in.; three of the tubes are of manganene and have terminals at one end, they being connected together by means of a traveling brush adjusted by a screw and wheel handle; a large copper tube is used as a common return; the tubes are mounted vertically in a frame and can be variously coupled.

Localizing a Fault.—Another formula giving exactly the same results as that suggested by Mr. Cann in the article abstracted in the Digest last week, in given in the Lond. "Elec. Rev.," Oct. 11; some corrections of that article are also given.

Ampere-Hour Meter.—The "Elec. Rev.," Oct. 23, reprints the article describing the Collinson meter, which was abstracted in the Digest last week.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Formosa Cable.—The "Elec. Friend" (Japan) for August, states that at present there are two small tanks for submarine cables in Yokohama and the government is preparing to complete four new ones at Nagasaki, each about 60 feet in diameter, this city being located conveniently for the new Formosa cable. At present it takes about six hours to communicate between Formosa and Japan via China and Corea lines, but the island is now to be directly connected with Japan by a cable under Japanese control; the cables will be made in England and laid with English ships.

Telephony in Japan.—The "Elec. Friend" (Japan) for August, states that the number of calls from the subscribers for the 12 months ending March, 1895, in the cities of Tokio, Yokohama, Osaka and Kobe, was 13,497,804; the total charge for this service amounted to nearly $64,294; the increase in number of calls over that in the preceding year, is 75.2 per cent., and the increase in income 38.4 per cent.

Telephonic Experiments with a Bare Conductor.—A translation of the article abstracted in the Digest, March 9, describing some experiments made by the German Postal Telegraph Administration, is given in the Lond "Elec.," Oct. 11.

MISCELLANEOUS.

Lightning.—The "Elec Friend" (Japan) for August, states that during the severe thunder storms in the Nagoya district on August 10 to 15, the lightning struck over 138 different places, killing several persons and destroying many buildings.

Lightning and Lightning Protection.—In an article on this subject by Mr. Summers in "Elec. Eng'ing," for October he quotes largely from the controversy between Dr. Lodge and the lightning rod conference of British scientists held in 1881; also from the Bulletin of the Department of Agriculture of which a long abstract was given in the Digest, Oct. 5. He concludes that the present method of protecting houses of consumers of energy supplied by overhead wires, is inadequate; a large number of arc light circuits are protected only by arresters in the station which are intended only to prevent damage to the dynamos; he considers that the modern specifications for fished wires are none too severe and that fireproof material and separation from anything liable to invite a discharge, are absolute necessities; these specifications should be severe, although in many cases they would almost prohibit wiring a house after erection; but he believes that effective protection is assured on all new work.

Biographical.—A short biography with a full page portrait of Frank J. Sprague is published in "Elec. Power" for November.

Phosphorescence After the Passage of an Electric Discharge.

Some recent experiments have been made by a French scientist, M. Seguy, on the phosphorescence of rarefied nitrogen after the passage of an electric discharge. He found that nitrogen in the presence of a metallic bi-chloride (stannic chloride, for example) phosphoresces like oxygen after an electric discharge. The light emitted during the discharge is pink, and the phosphorescence milky white of greatest intensity immediately after the break of the current and gradually diminishing until it disappears at the end of 10 to 80 seconds.

New Books.

THE GALVANOMETER. By Edward L. Nichols. New York: McIlroy & Emmet. 112 pages, 77 illustrations. Price, 50 cents.

This pamphlet of something over 100 pages embodies a series of lectures delivered before the students of electrical engineering in Cornell University. It begins with the mathematical theory of galvanometers for absolute measurement. The expressions for the galvanometer constants in terms of the dimensions of the apparatus are deduced, and also the corrections to be applied on account of nonfulfillment of theoretical conditions. These are carried out further than usual except in the most advanced treatises, and bring before the student in compact form material that he would find it difficult elsewhere to obtain except by wading through many pages of heavy mathematical discussion. Lecture III treats of the ballistic galvanometer, giving a full discussion of the effect of damping. Lecture IV treats of the methods of determining the strength of the magnetic field. Then follows a description of galvanometers with artificial fields, and examples of their use in recording rapid fluctuations of current.

The sixth lecture treats of the construction of galvanometers of extreme sensitiveness, and in the following lectures several applications of such galvanometers to extremely delicate measurements are described, among them the use of the bolometer for radiant heat investigations. These chapters contain considerable new matter, besides bringing together a number of observations and results only to be found elsewhere in original papers which describe the galvanometer and its working only as accessories in widely differing investigations.

TELEPHONE TROUBLES AND HOW TO FIND THEM. A Complete Handbook for Telephone Inspectors. By W. H. Hyde and J. A. McManman. Sixth Edition. Milwaukee: W. H. Hyde & Co. 50 pages, 9 illustrations. Price, 25 cents.

This useful little book, formerly edited by Mr. C. H. Haskins, has entered into a sixth edition, to which considerable new matter has been added. The handbook, as stated in the title, is intended for inspectors, and gives information as to how to remedy the various troubles that arise in telephonic service. As an example of the method of treatment, we will take the section on magneto bells: The construction of magneto call bells is explained, and directions follow applying to the case when a bell will not ring, including a test for locating a break if one is indicated; instructions for the case when a bell receives and transmits a ring feebly, when it rings other bells strongly but its own bells are weak, when it rings other bells feebly but receives a ring from other bells strongly, when it will not ring its own bell or others but receives a ring, when it rings frequently without cause, when it rings its own bell and will not receive a ring and you cannot talk; when it receives and transmits rings but you cannot talk. The same method is followed with respect to the hand telephone, flexible cords, batteries, transmitters, annunciators, inside wiring, lines, ground wires, connections, lightning arresters and lightning troubles. The concluding sections consist of specific instructions to inspectors, a table of an inspector's outfit and a wire table.

Phase and Frequency Transformation.

A patent was issued Oct. 8, (No. 547,683) to Prof. Henry A. Rowland, on a method of varying the frequency and number of phases of polyphase currents. The object of the invention is stated to be to vary the frequency of polyphase currents from zero to any desired frequency; to produce means for starting synchronous and other motors and causing them to run at different speeds, and to accomplish with other translating devices a variety of results of like nature. This object is attained by means of the combination with a commutator, either stationary or revolving, of brushes, which also may be either revolving or stationary. The bars of the commutator are joined by conductors to the source of electricity, either directly or by means of contact rings or brushes, and the current is carried from the commutator by brushes, either fixed or revolving independently of the commutator; or the current may enter by brushes and be carried off by the commutator brushes. Currents may be taken directly from the brushes or commutator bars when they are stationary, or through contact rings or other brushes when revolving.

In the accompanying diagram four different methods described in the patent are illustrated. The transformers to the left are for connection with a two-phased system, and are each wound with six secondary coils, the length of the coils and the connections being so arranged as to produce an eight-phased system. The upper device to the right represents a revolving commutator and fixed brushes, the conductor leading directly from the brushes to the contact brushes of the motor or dynamo. The device below differs from this in having the commutator stationary and the brushes revolving. The third device shows a lead of conductors somewhat different from the upper one, while the lower one shows a lead somewhat different from the construction given in the second device.

A continuous current will be carried off by the pairs of conductors to the right in the diagram, provided the corresponding devices run in synchronism with the current, while an alternating current will be carried off at any other relative speed, the polyphased current from the transformer

being converted into a continuous or alternating current by means of the commutator, *A*, and the brush, *F*, either or both of which may be made to revolve. The speed of the commutator necessary to produce continuous currents can be reduced one half, one third, etc., by making the number of the commutator bars, 2, 3, etc., times the number of wires from the transformer. By means of the arrangement shown, therefore, it is possible to transform an alternating current of any number of phases or frequency to another alternating current of any desired number of phases or frequency, and to further change these latter currents, either into a

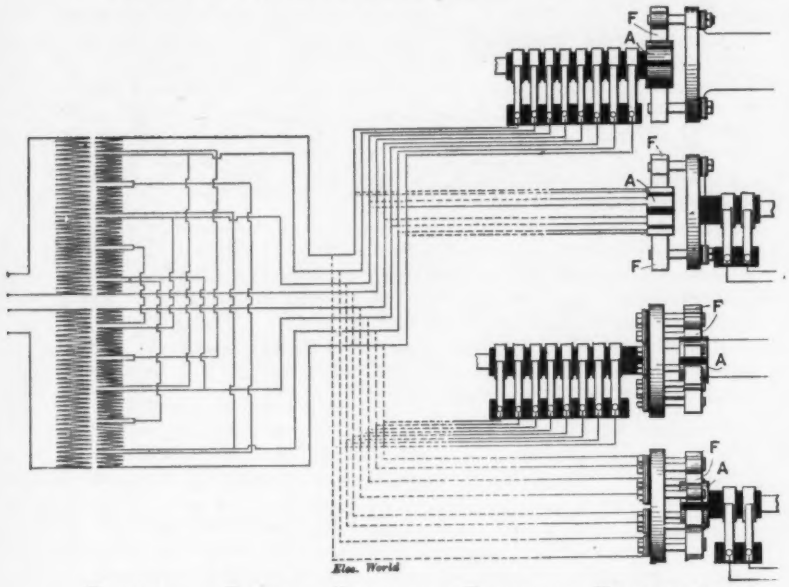
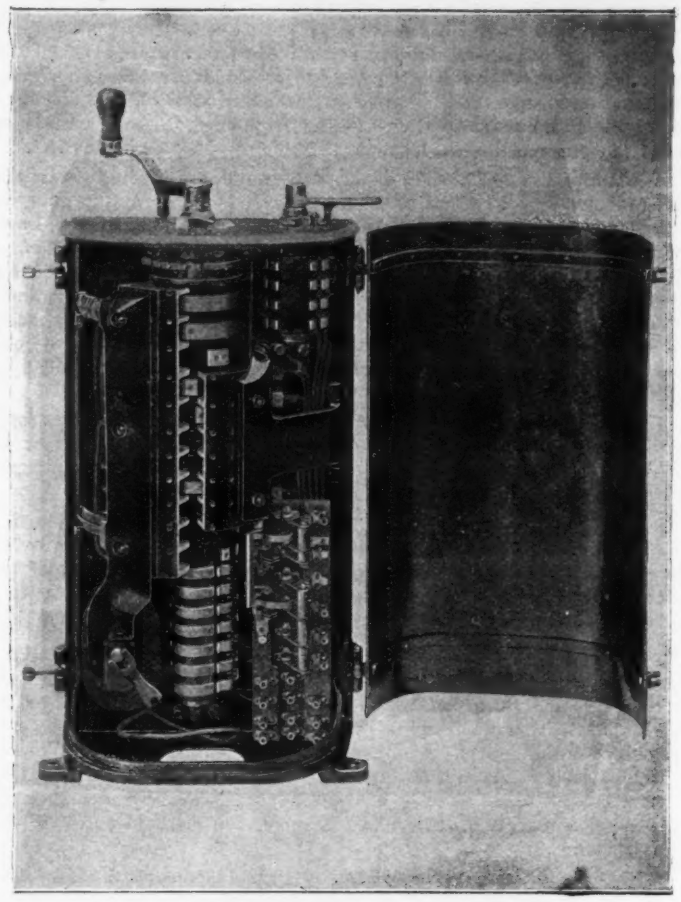


Diagram of Rowland Phase and Frequency Transformer.

continuous current or alternating current of a greater or less number of phases or frequency, and to run a synchronous or induction motor at any desired speed, to start the same under any load and to accomplish many other results that would readily suggest themselves to a skilled electrician.

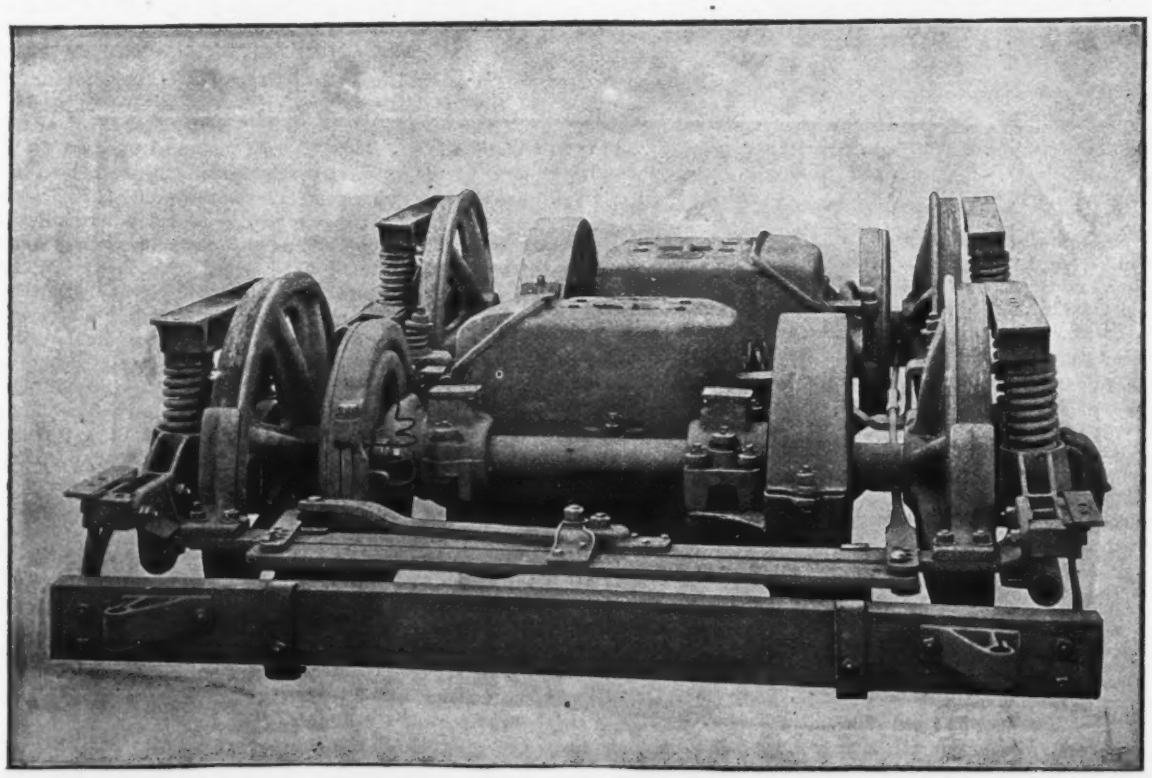
Electric Brake for Street Railway Service.

The illustrations below show a modification of the Sperry electric brake for street cars, which is now being manufactured by the General Electric Company. Among the points claimed for this brake is that, owing to the fact that the braking power is not derived from the central station, but is generated by the motors themselves, the operation of the device is not interfered with by the jumping of the trolley from the wire. The brake places the car under the absolute control of the motorman, and its operation is no more complicated than the operation of the ordinary controller. Indeed, the controller not only controls the motors, but at the same time operates the brake, starting, accelerating, retarding and braking the car. When making a stop, the controller handle is simply thrown from running to braking position, and electricity does the rest. The operations are, the cutting out of all connection with



Controller Used in Connection with Brake.

the trolley current, the conversion of the motors into special dynamos for generating current at very low speeds and the instant application of the brakes. The rheostats and contacts used to control the motors in running the car, also control the current generated by the motors to operate the brake. The rotating armature of the motor, instead of tugging ahead through its momentum, is itself pulling back and more or less pow-



Car Truck Equipped with Electric Brake.

erfully braking the car through the gears by the retarding effort of its magnetic field while generating the braking current. The power, therefore, required to perform the work is taken from the energy of the moving car. Not only is the car thus retarded, but the brakes arrest the motion of the wheels directly with a powerful force under perfect control of the motorman. The combined electric brake and series-parallel controller is the K-2 controller slightly enlarged and provided with the necessary contacts to perform the operation described above. The brake mechanism is readily attached to the motor and axles, and consists of a cast-iron disc keyed to each axle and a compact electromagnet facing each disc and attached to the motor frame and prevented from revolving by suitable lugs. The maximum current in the brake circuit is regulated by a switch adjusted to limit the current automatically to an amount just under the slipping point of the wheels. Independently of this switch, the brake pressure can be graduated by the controller handle and a smooth, even motion secured on descending long grades. The disc and shoe are lubricated by a graphite brush, carried in the shoe and pressing against the brake disc. This prevents excessive wear from friction and reduces the resistance between the shoe and disc, an important feature, as the eddy currents set up in the brake and shoe are even more effective in stopping the car than the simple friction between the shoe and disc. The installation connections of this mechanism are extremely simple.

The advantages claimed for the electric brake are that it can be applied to any axle without removing the wheels, and the wear and tear of the brake does not come upon the tread of the wheel. The wheels of the car cannot skid, thus eliminating the possibility of flat wheels and consequent rapid depreciation of rails and rolling stock.

New Electric Car Heater.

The accompanying engraving represents a new car heater which has been put on the market by the Interior Conduit and Insulation Company, 527 West Thirty-fourth Street, New York, and which differs from other similar devices in several important respects.

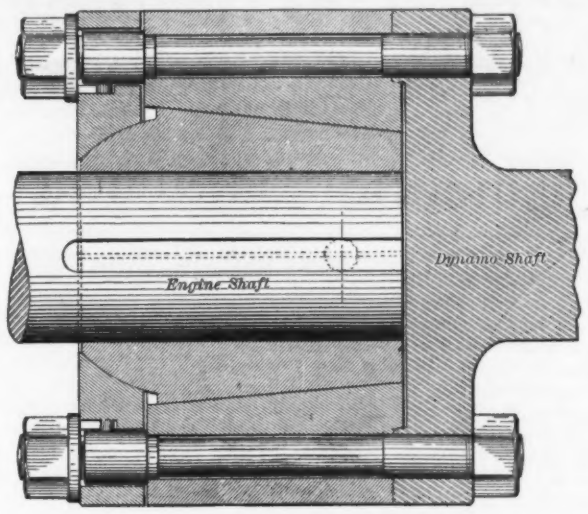
The construction of the heater is such that heat is not merely produced in the coils and left to find its way out into the atmosphere of the car as best it may, but special means of radiation have been provided which insure the proper diffusion of heat units as fast as they are produced. By its peculiar construction, the cold air of the car is drawn into the heater and a steady continuous stream of hot air delivered in its place; the air cannot pass by or around the heater coils, but must, on account of the design of the apparatus, pass directly through them, which fact results in considerable saving in the power necessary to produce a given temperature in the car.

The heaters are substantially built, very neat in appearance and are easily installed, the standard size being made to work four in series for an ordinary sized car or six in series for an extra long car. These heaters are strongly guaranteed by the manufacturers against all danger from fire, and each set requires four amperes of current at 500 volts E. M. F. to give the best results.

ELECTRIC CAR HEATER.

Coupling for Direct-Connected Outfits.

We illustrate herewith a new type of coupling, designed for connecting the shaft of a slow-speed generator with that of an engine, for direct driving. The device is made by the Straight Line Engine Company, of Syracuse, N. Y., builders of the "Straight Line" engine, and it has been successfully used by them in a number of instances. One half of the coupling is a flange, preferably forged, but allowably shrunk on the shaft of the dynamo. The engine shaft carries a split cone, which is prevented from turning by a key; an outer shell, bored out to a taper corresponding with the periphery of the cone, is drawn over the latter, tightening it down on the shaft, and making the whole coupling practically solid, except when subjected to some sudden abnormal strain, such as would be caused by a short circuit on the generator, which would result in the slipping of the coupling and the consequent saving of the armature.

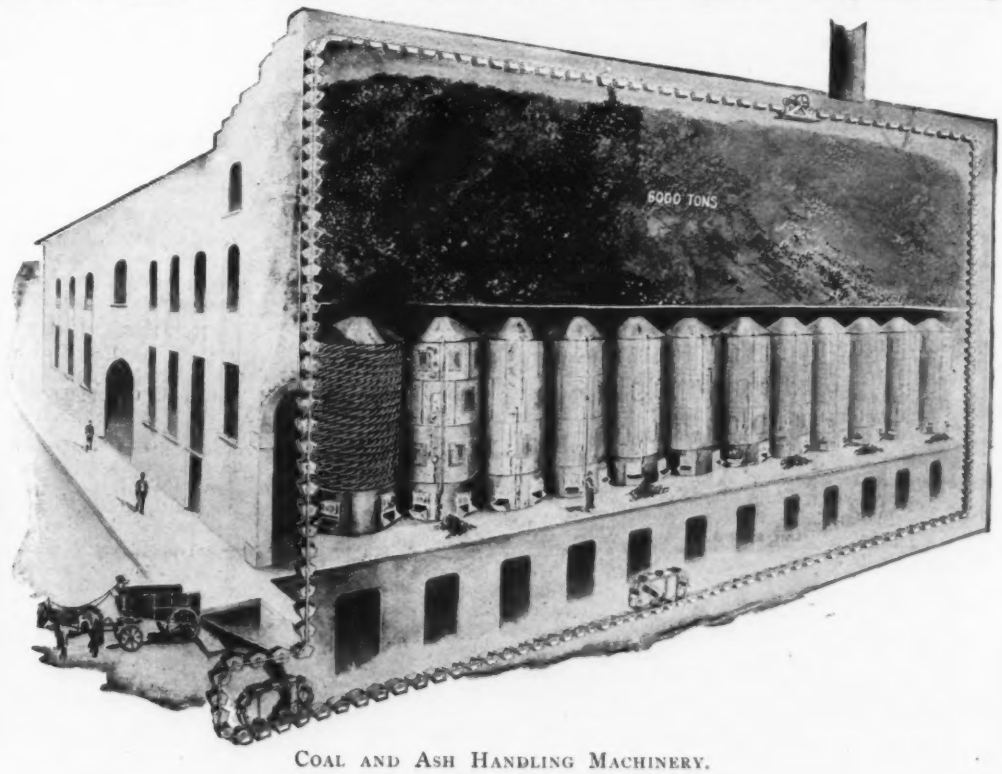


DYNAMO AND ENGINE COUPLING.

A Large Coal and Ash Handling Plant.

The United Electric Light & Power Company of New York, has recently erected an electric light and power station on Twenty-fifth Street, near the East River, this city, which, when completed, will have a capacity of 19,200 hp. One half of the station is built on a lot 98½ feet wide by 161 feet long, and has a coal storage capacity of 3,000 tons. In this part of the station there will be eight engines of 1,200 hp each, driving dynamos of 80,000 lamps aggregate capacity. The current used is two-phase alternating and the generators will be run in parallel. The station is equipped with a fine coal and ash handling plant, furnished by the C. W. Hunt Company, of 45 Broadway, New York. As the station is not situated on the water front, the coal is received in wagons, as shown in the accompanying engraving, and dumped into the hopper under the sidewalk, whence it is carried by a Hunt "Noiseless" conveyor to the top of the coal storage building over the boilers.

This storage bin is so constructed that all the coal will run to the boilers, and the plant is arranged so that at any time an improved designed of stokers might be used. On its return, the conveyor runs under the boilers and the ashes are drawn into the same conveyor that handles the coal, and carried to an ash tank (not shown in the engraving), from which they are removed at will.



COAL AND ASH HANDLING MACHINERY.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 26, 1895.

THE ELECTRICAL STOCK LIST continues almost entirely stagnant, no trading of any account being done outside Electric Storage and a few of the traction stocks.

ELECTRIC STORAGE was given a temporary boost during the week by reports of large deals about to be consummated with the Brooklyn Bridge and Manhattan Elevated authorities. Failure to confirm these reports, however, had a depressing effect upon the stocks, which closed slightly off from last week's figures.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company..	100	120	125
Edison Electric Ill., New York	100	98	98½
" " " Brooklyn	100	110	115
" " " Boston	100	..	152
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	71½	72¼
Electric Storage, pref	100	73	74
General Electric	100	35¾	36
General Electric, pref	100	67	68
Westinghouse Consolidated, com	50	35	35½
" " pref	50	55	55½

BONDS.

Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	198	199
American District Telegraph	100	35	40
American Telegraph & Cable	100	94½	98
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	68¾	69
Gold & Stock Telegraph	100	105	..
New England Telephone	100	88	89
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	91	91⅜

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	18	18¼
Binghamton RR. com	100	100	..
Brooklyn Traction	100	12	14½
" " pref	100	60	63
Buffalo St. Ry	100	86	88
Cleveland City Ry	100	69	70
Cleveland Electric Ry	100	59	60
Columbus St. Ry	100	55	57
Consolidated Traction of N. J	..	25	..
Electric Traction, Philadelphia	50	66	66½
Hestonville	100		55½
Long Island Traction, all pd	100	19½	20
Louisville St. Ry. com	100	37	39
" " " pref	100	87	88
New Orleans Traction	100	19½	21
" " pref	100	70	73
North Shore Traction	100	36	37
" " pref	100	88	89
People's Traction $30 pd	25	58	58½
Philadelphia Traction	50	75½	75⅞
Rochester St. Ry	..	34	37
Union Ry. (Huckleberry)	100	112	115
Union Traction, rcts $5 pd	..	10½	19¾
West End. Boston	100	69	69¾
" " pref	100	89	90
Worcester Traction	100	16	18
" " pref	100	87	89

BONDS.

Buffalo St. Ry. 1st con. 5s	100	108	110
*Binghamton Railway Co. 5s	100	99	100
Cleveland Elec. Ry. 1st mtge 5s	100	102	104
*Columbus St. Ry. 1st 5s	100	100	102
Rochester St. Ry. 1st 5s	100	102½	104
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Div.

THE NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY'S one and one fourth per cent. quarterly dividend to be paid Nov. 15, is at the same rate as that paid Aug. 15, but an increase of one per cent. over each of the four quarterly dividends previous to that. It makes four and one half per cent. for the calender year 1895, against four per cent. for 1894 and three and one half per cent. for 1893.

THE TRACTION MARKET continues inactive and weak. Buffalo railway stock remains firm around 86, while the bonds have declined somewhat on very limited trading. Both Citizens' (Indianapolis) and Rochester railway stock sold off during the early part of the week, due presumably to the fact that the Philadelphia banks have determined to insist upon more margin when loaning on securities of this class. As the above stocks are more actively traded in than the rest of the traction list, they were naturally the first to react. Both closed considerably higher, however, and show signs of further strength. The report that some of the Brooklyn trolley roads would be allowed to run cars over the new East River Bridge, when completed, has had no appreciable effect as yet on the price of the securities of the various companies. This privilege, if granted, should largely increase their earnings.

BALTIMORE TRACTION remains practically unchanged a couple of points below ruling prices of two weeks ago, in the face of the fact that the road's earnings are steadily increasing at the rate of about $500 a day.

COLUMBUS STREET RAILWAY reports from Jan. 1 up to and including the third week in October gross earnings of $506,509, an increase of $54,837. In spite of the continued increase in the earnings of the New Orleans Traction Company, the stock, both common and preferred, continues dull and weak. The September reports show earnings of $111,648, an increase of $30,075, and the net earnings for the month show a gain of $21,282.

Special Correspondence.

NEW YORK NOTES

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Oct. 28, 1895.

MR. E. C. MOXHAM, of Hoefgen, Moxham & Co., 80 William Street, dealers in electric railway supplies, has just finished a business trip through Western territory, and reports most gratifying results from his trip.

A COURSE OF FIFTY LECTURES on electrical engineering will be delivered by Mr. F. M. Pedersen, E. E., before the Association Business Institute, at the rooms of the Twenty-third Street branch of the Y. M. C. A., Fourth Avenue and Twenty-third Street, on Wednesday and Saturday evenings through the Winter.

CHARLES A. SCHIEREN & CO., of 45 Ferry Street, have just received an order for 3,200 feet of belting to go to Mexico, and an order for 3,500 feet of plain belting to go to South Africa, besides a complete equipment of the well-known perforated "Electric" belts for one of the first electric street railways to be constructed on the "Dark Continent."

J. H. VAIL, supervising engineer, No. 39 Cortlandt Street, is executing some important construction work, including the new central station of the Wilkes Barre Electric Light Company, which is a model of convenience, and the new electric lighting, elevator and power plant, for the State Mutual Life Assurance Company at Worcester, Mass., which will be a fine example of advanced electrical engineering when completed. Several important railway and power transmission systems and foreign electrical engineering contracts are in Mr. Vail's charge.

A. O. SCHOONMAKER, 158 William Street, whose name and product are already perfectly familiar to all users of mica, never neglects an opportunity to maintain his touch with the trade. With this end in view, and also to simplify the ordering of mica cut to shape, Mr. Schoonmaker recently prepared large sample cards to which were attached all standard shapes and sizes of mica stampings, with trade designations for identification. The cards were distributed throughout the trade, and the results demonstrate conclusively that the convenience of these sample cards is heartily appreciated.

THE SOLAR ELECTRIC COMPANY, of 65 Duane Street, has been reorganized, Messrs. G. A. Mullen and Louis Winters being no longer identified with the concern. The recent trouble experienced by the Solar Company with its employees has been adjusted to the satisfaction of all concerned, and the company is in position to handle promptly its rapidly growing business. A magnificent switchboard has just been shipped to the Vanderbilt place in North Carolina for the isolated plant there, and another fine board is under construction for the Public Printing Office, Washington, D. C. Solar arc lamps are also commanding the attention of the trade, and the company is constantly in receipt of flattering testimonials from users of these high-class pieces of apparatus.

A FIFTEEN-FOOT LIST of users of Harrisburg "Ide and Ideal" engines is being distributed by W. R. Fleming & Co., 203 Broadway, sales agents for

these engines, and when it is considered that each inch of the list covers a dozen names, the popularity of these engines strikes one most forcibly. The list represents something like 2,000 sales, aggregating over 150,000 hp, which have been effected by this remarkably wide-awake and successful firm, whose customers are distributed over almost every State in the Union. Among a number of strong points claimed by Messrs. Fleming & Co. for their engines are the only concentric adjustable piston valve made; tight valves at 125 pounds pressure, which can nevertheless be moved over the ports by hand; noiseless operation and the fewest number of running parts; dust-proof bearings and absolute freedom from the throwing of oil; regulation within one per cent., from no load to full load; and the ability to run under full load without being bolted to foundations.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 630 Atlantic Ave.,
BOSTON, MASS., Oct. 26, 1895.

THE THOMPSON-BROWN ELECTRIC COMPANY has engaged the services of Mr. T. M. Clifford in its accounting department. Mr. Clifford was for six years connected with the auditing department of the Thomson-Houston and General Electric companies.

MR. E. G. MCOUAT has succeeded Mr. E. E. Cary as superintendent for the Beacon Lamp Company. Mr. McOuat has been connected with the Beacon Company since it commenced business, immediately previous to which he was identified with the lamp department of the Westinghouse Electric Company, and earlier with the old United States Lighting Company, and was in the laboratory of Edward Weston for several years—connections which abundantly justify the promotion he has received with the Beacon Company.

THE ANCHOR ELECTRIC COMPANY has just issued a handsome catalogue and price list in which are illustrated the various sockets, switches, cut-outs and all other electrical specialties manufactured by it, all of which is preceded by a well-executed cut showing the interior of its spacious and busy factory, and which, so far as activity is concerned, is also representative of its storerooms and office at 71 Federal Street. This company is doing a thriving business, and is taxed severely in taking care of its numerous and increasing orders.

THE COMMITTEE representing the Dublin (Ireland) Tramway Company, which is about to build an electric railway in that city, and who are traveling through the United States for the purpose of securing all possible information with regard to both trolley and underground systems, their effect on real estate, etc., visited Boston this week, and called upon Mayor Curtis and General Manager Sergeant, of the West End Street Railway Company. The gentlemen comprising the committee are Dr. Carte, Mr. Anderson, Mr. Wigham and Mr. Murphy.

W. D. HOFFMAN & CO., engineers and contractors, 620 Atlantic Avenue, have a very atttactive exhibit of the McClave system for burning cheap fuel at the Mechanics' Fair. An 85-hp boiler is fitted with the grate and is supplying 105 hp of steam for the extra electrical and fountain equipment. No. 1 Buckwheat coal is used, which costs 30 per cent. less than the egg coal used on ordinary grates with natural draft. The system is open for inspection and a sectional exhibit is made in another portion of the hall. Several orders have been booked from the showing made at the fair. The Phœnix Iron Works Company is also represented by W. D. Hoffman & Co., as New England agents, and has on exhibition a 10½ x 12 "Dick & Church" engine.

MR. J. H. GRAHAM, manager of the Graham Equipment Company, returns from the Montreal Convention greatly enthused over the kindly attention accorded the exhibits of his railway specialties, particularly his steel frame for street cars, which is a distinct advance on the present arrangement of separate car body and separate truck, and embodies also Graham's spring suspension and equalized brakes. Some six weeks previous to the Convention, the Toronto Street Railway Company, of Toronto, Ont., through its superintendent, Mr. James Gunn, opened negotiations for the right to build these steel frames in Canada. The Graham Company intended to exhibit a complete car, but in view of the fact that the Toronto Street Railway Company desired to build its cars in Canada, decided to send only a steel frame, which would show the salient features of the frame to street railway officials, and could also be shipped to Toronto as a pattern. Superintendent Gunn and Master Mechanic Powers were both in attendance at the Convention, and the frame after the exhibition, was shipped to Toronto.

PITTSBURG NOTES.

THE PITTSBURG, JEANNETTE & GREENSBURG ELECTRIC RAILWAY COMPANY has purchased the entire plant and rolling stock of the Greensburg & Hempfield electric road, which is about two miles in length, for the sum of $59,000. The tracks, which were laid about seven years ago, will be changed to standard gauge, and connected with the main line of the P. J. & G. road. The line will be fitted out with new cars and motive power. The first section of the Pittsburg, Jeannette & Greensburg Electric Railway will be completed by Nov. 1. The section between Greensburg, Jeannette and Manor, where the power house is located, is some six miles long. A number of double truck Brill cars, with 50-hp Westinghouse motors, will be started by Nov. 10.—The wholesale and retail electrical supply houses here are somewhat behind with orders and contracts, and a considerable rush is setting in as the season advances. Local dealers report having more than double the trade they had at this time in 1894.—It seems there is no let up in the war inaugurated by the Pennsylvania Railway Company, against the interurban electric railway companies to prevent the latter from cutting into the short-haul travel of the steam roads. There are millions of dollars tied up in investments in country electric railway lines that cannot be utilized until there is some change in the street railway laws. If the Pennsylvania Railway Company can prevent it that capital will continue to lie idle. Suits brought by the Pennsylvania against some half dozen electric railway companies, that threaten the existence of the latter, are still pending, and last Monday another suit was entered against the Braddock Electric Railway Company. The pretext for the previous suits was the crossing by electric railways of the steam railway tracks on grade, but in this case there is no such excuse. The electric railway company wants to cross the railway tracks by an overhead bridge, but even this is objected to. The Braddock Railway Company has served notice on the Pennsylvania Company of its intention to construct this bridge, and is about to go to work. The court is asked to grant an injunction restraining the electric railway company from constructing its bridge, or in any other manner crossing the tracks and property of the railway company.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Oct. 25, 1895.

THE WHITE MANUFACTURING COMPANY, 40 and 42 State Street, has brought out a very fine catalogue of electric and combination fixtures which are in good demand throughout the West. Designs of all classes of electric and combination fixtures are shown, and many new specialties of decided merit are included. A careful perusal will repay any one contemplating the purchase of fixtures.

CONTRACTS for the electric equipment for the Mabley Building, Detroit, have just been let, through the office of Chas. G. Armstrong, Chicago, and were awarded as follows: Three 130-kw and one 45-kw multipolar generators to the General Electric Company; three 200-hp tandem compound engines and one 75-hp simple engine to the Ball Engine Company; wiring for 4,000 lights to F. P. Jones & Co., of Buffalo. The building is also to be provided with nine Sprague electric elevators, and a number of other features which are new to the modern office buildings.

MR. FOREE BAIN has been selected by the West Side Board of Park Commissioners as engineer to design and install an electric light plant for the purpose of illuminating the parks and boulevards in the city of Chicago. The plant will consist of 1000-hp boiler capacity, two 500-hp compound condensing Corliss engines, eleven 100-light arc dynamos, and all necessary shafting, pulleys, etc. There will be one thousand 2000-cp arc lamps hung from specially designed poles. The wire will be placed underground, necessitating the use of about 100 miles of underground lead-covered cable. When finished the plant will be a model. It is Mr. Bain's intention to construct the plant with a view to making the cost of operation a minimum. The work of placing the conduit will be begun at once, but apparatus will probably not be required before the first of the year. Mr. Bain is now drawing specifications for the apparatus required.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Oct. 16, 1895.

ELECTRIC TRACTION.—If a resolution arrived at a few days ago by the Dover Town Council is persisted in, this somewhat sleepy old town will shortly lead the way in this country in the matter of electric traction. The resolution of the Town Council was to the effect that a sum of £50,000 should be obtained for the purpose of equipping the town with a complete system of electric tramways.

INVERTED ARC LIGHTING—.The use of inverted arcs continues to grow apace in this country. One of the latest examples is to be found at the Birmingham Municipal Technical School, where this system of lighting is largely used, especially in the drawing offices and machine shops. The lighting of this institution, the principal of which is Dr. W. E. Sumpner, has been very carefully carried out, and presents many features of interest. Few schools of the kind in this country are so thoroughly well and scientifically equipped as this.

MUNICIPAL ELECTRICAL ENTERPRISE.—A batch of municipal electric lighting stations has just come into operation. Last week an alternating-transformer sub-station system was inaugurated at Tunbridge Wells, and this week two municipal stations were opened at Stafford and Monmouth, using respectively the continuous-current and the alternating-current systems. At Plymouth Dr. J. A. Fleming has recently made a report on behalf of the Town Council, which is ambitious of doing not only its own electric lighting, but also its own electric traction, utilizing, of course, the ash-bin refuse of the town for generating heat, this idea being at present a decided craze with our municipal authorities.

ELECTRIC LIGHTING IN THE WEST END.—When the shops are shut up in the West End the streets of that quarter are probably the worst lighted of any large city in Europe. The local authority in charge of that particular district is at last arousing itself to the necessity of better lighting, and has entered into negotiations with the two companies supplying current to that district, viz., the St. James & Pall Mall Electric Lighting Company and the London Electric Supply Corporation. The offer of the St. James Company is to supply 69 10-ampere arcs for the sum of £30 per annum. This price is considerably above the ruling rate in this country, but perhaps the St. James Company is endeavoring to make a little profit out of its public lighting, a thing which few other companies are bold enough to attempt.

General News.

ELECTRIC LIGHT AND POWER.

LESUEUR, MINN.—C. F. Loweth, of St. Paul, has been engaged by the city to draw plans and superintend the putting in of electric light works.

NEW CASTLE, PA.—A proposition to light the streets of New Castle by electricity has been referred by the City Council to the Light Committee.

OTTAWA, ILL.—The Western Cottage Piano & Organ Company will erect a $30,000 factory, which will be equipped with an electric light plant of its own.

DEXTER, MO.—At the election of the city of Dexter the electric light franchise for 10 years was voted to E. L. Hawks, of Puxico, and Grant Gillespie, of Dexter.

VIRGINIA, MINN.—The Virginia Light & Water Company will commence at once to construct an electric line from its power house in Virginia to the Village of Eveleth.

EAST ORANGE, N. J.—The East Orange Township Committee has granted a franchise to the Suburban Electric Light & Power Company to erect poles and string wires in the township.

WOONSOCKET, R. I.—The electric light committee of the town of Blackstone has awarded the contract for lighting the streets with 2,000-cp arc lights to Robert B. Tabor & Co., of Boston, Mass.

REYNOLDSTON, PA.—The Reynoldston Borough Council, on Oct. 18, referred to the Light Committee the proposition of the McKeesport Light Company to furnish the borough with twelve arc lights.

ROCKVILLE CENTER, L. I., N. Y.—A petition has been presented by the town of Hempstead Electric Light & Power Company to the Board of Trustees of this village for a franchise for electric lighting privileges.

WATERFORD, N. Y.—A special meeting of the Village Trustees was held Oct. 17 to consider electric street lighting. Representatives of the Beacon Electric Light Company, of Lansingburgh, appeared, and made a proposition for lighting the city.

RUSHVILLE, IND.—The city authorities have granted the Rushville Water Company a 20-year franchise to construct and operate a system of water works and electric lights in the city. The present electric light plant, valued at $5,000, was taken over by the Water Company.

SHENANDOAH, PA.—Ex-Councilman A. D. Lamb has made application to the borough council for right of way for the poles and wires of a corporation known as the Delano Heat, Power & Light Company, which proposes to furnish light, heat and power in the borough.

SACRAMENTO, CAL.—Dr. Charles Vannerden, representing the South Cuba Canal Company, has asked the Board of Supervisors for a franchise for the Central California Electric Company to enable it to bring electric power through the county to the city of Sacramento.

CHICAGO, ILL.—Sealed proposals will be received at the office of the Comptroller, until Nov. 2, for furnishing the city of Chicago with about 20,000 feet of Kerite single conductor electric light cables, as per specifications on file in the office of the superintendent of city telegraphs.

TRENTON, N. J.—The new electric light plant will probably be located at the foot of Farnsworth Avenue. Those interested in the company are James S. Gilbert, George G. Gilbert, Amos L. Lyttle, Thomas Dennett and Wm. C. Steele. Work will be begun as soon as possible.

HICKSVILLE, L. I., N. Y.—The Town Board of Oyster Bay met at Hicksville, Oct. 18th, and a petition was presented by a representative of the Long Island Electric Company, bearing the names of 25 resident taxpayers of Hicksville and vicinity, asking the board to grant permission to this company to furnish electric lights to the village.

ROME, N. Y.—Sealed proposals for lighting the streets of Rome with electric lights will be received until five p. m., Nov. 18. Proposals must be for one, three or six years, for 150 arc lights, of 2,000 cp, burning every night from sunset to sunrise. For further particulars address Alderman John F. Atkinson, chairman of Lamp Committee.

FOSTORIA, O.—At the meeting of the Council, the light committee was granted further time to prepare specifications for street lighting. Councilman Wood asked that the committee be authorized to advertise for bids for a street lighting system as soon as the specifications are completed, or that a special session be called, to act on the specifications.

THE ELECTRIC RAILWAY.

SEBEC, ME.—An electric railway is projected from this town to Dover.

SCHUYLERVILLE, N. Y.—Either an electric or steam road to Greenwich is contemplated.

NORTH TONAWANDA, N. Y.—The North Tonawanda trolley franchise has been revoked.

SAYRE, PA.—A large addition is to be made to the Waverly, Sayre & Athens Traction Company's power house.

DETROIT, MICH.—The Citizens' Street Railway Company will probably double-track all of its Trumble Avenue Line.

WEST FAIRVIEW, PA.—The question of an electric road from West Fairview, connecting Marysville with Harrisburg, is talked of.

DETROIT, MICH.—The Detroit & St. Clair River Electric Railway Company has filed a mortgage for $358,000 for the purpose of building a road.

XENIA, O.—The Rapid Transit Company, recently incorporated, proposes to construct a line of railway along the pike between Xenia and Springfield.

MONTCLAIR, N. J.—The Town Council at its meeting on Oct. 21 refused to grant the trolley franchise applied for by the North Jersey Traction Company.

WEEDSPORT, N. Y.—The construction of a belt line electric railway, connecting Auburn, Port Byron, Weedsport, Jordan and Skaneateles, is in contemplation.

ALBANY, N. Y.—The railway commissioners have approved of the use of electricity as a motive power on the New York, Elmsford & White Plains Street Railway.

BOSTON, MASS.—The West End Street Railway Company has asked the city authorities for permission to establish a double-track line along Columbus Avenue and other streets.

MOBILE, ALA.—At a meeting of the City Council the report of the committee on the petition of the Mobile Street Railway Company to extend its Dauphin Street tracks was adopted.

EDGEWATER, S. I., N. Y.—The Staten Island Electric Railway Company is laying tracks on the Clove Road, notwithstanding the claim of possession made by the Midland Company.

CHICAGO, ILL.—It is reported that the Chicago City Railway Company will considerably extend its lines, so as to reach the part of Hyde Park which is not now covered by any railway.

SHAMOKIN, PA.—Work will be commenced at once on the new trolley line between Sunbury and Selin's Grove, a distance of 10 miles. Major J. H. Hamilton, of Shamokin, is one of the projectors.

DENVER, COL.—An electric railway through Queer Creek Valley is contemplated, to be known as the Denver, Globeville and Golden Rapid Transit line. F. C. Randall is general manager of the company, with an office at Eighteenth and Lawrence Streets.

HOBOKEN, N. J.—The Hoboken Railway, Warehouse & S. S. Connecting Company has received a franchise for the construction and operation for an electric railway along the river front to give communication between the various steamship piers, warehouses, etc.

DAMASCUS, MD.—A meeting of the citizens of Montgomery, Howard and Frederick counties was held at this place recently in the interest of the projected Washington, Sandy Springs, Baltimore & Ellicott City Railway, and the project was enthusiastically approved.

CHICAGO, ILL.—The Suburban Electric Railway Company has applied to the court for condemnation of a strip of land about a mile long, through the upper end of Riverside. The property has never been sub-divided, and right of way can therefore be awarded by a jury.

NESHAMINY, PA.—An electric railway is contemplated from the city line at Poquessing Creek north to Neshaminy Creek, a distance of about 20 miles, and a petition has been circulated among the property owners along the Bristol turnpike, for the purpose of obtaining consent.

CORTLANDT, N. Y.—At a meeting of the highway commissioners Attorney John Gibney, of Sing Sing, presented the application of the Croton Valley Electric Railway Company for a franchise to operate a trolley railway line between Croton-on-Hudson and the new Cornell dam.

MILWAUKEE, WIS.—Manager Wyman recently announced that negotiations were pending whereby the Milwaukee Street Railway Company and the Racine Street Railway Company expect to reach an agreement so that the Cudahy branch of the local line can be extended to Racine.

TONAWANDA, N. Y.—It is understood that capitalists are to resume operations and complete an electric road from North Tonawanda to Sanborn and Pekin. Louis Payne, attorney, has announced that he has succeeded in interesting several influential capitalists in the undertaking.

SALEM, MASS.—The Lynn & Boston Company has fully determined to equip and run the old Salem & Danvers Road with electricity, and also to extend its electric power from Gloucester crossing in Beverly to Wenham. The Managers of the Haverhill, Georgetown & Danvers Road have announced that they shall build part of their line this Fall and the work will be begun very soon.

BENNINGTON, VT.—Superintendent E. D. Bennett, of the Bennington & Rutland Railway, is consulting with electrical engineers as to the feasibility of substituting electricity for steam on the branch line between here and North Bennington. The success attending the introduction of electricity for short runs on the Baltimore & Ohio and New York & New England railways has caused the officers of the Bennington & Rutland to call for estimates, etc., as to what can be done on this line of their road.

ATLANTIC CITY, N. J.—The Camden & Atlantic Railway Company's injunction proceeding against the City Council has incensed that body. Last week the Council passed to its third reading an ordinance repealing its ordinances giving the company the right to operate its line on Atlantic Avenue. An ordinance was then introduced granting the Atlantic City Southern Railway Company the right to locate, build and operate a line of street railway on Atlantic Avenue and on several cross avenues. The new company agrees, in consideration of the right, to pave Atlantic Avenue from curb to curb, and to pay the city a license of $50 for each car. The repeal ordinance will be put on its final passage at the next meeting of the Council. The new company is backed by Philadelphia capitalists.

Trade and Industrial Notes.

THE MUNCIE ELECTRICAL WORKS, Muncie, Ind., has been purchased by Lafayette capitalists, and will be removed to that city and the scope of its operations enlarged.

F. A. CULIN & SONS, electrical contractors, Provident Building, Philadelphia, announce that on Nov. 1, 1895, Wm. D. Culin, M. D., will retire from the firm, which will thereafter be known as F. A. Culin & Son, F. H. Culin being the other partner.

MR. EDWARD GRACE, vice-president of the Portable Hose Bridge Company of Detroit, Mich., "made hay" at the Montreal Convention, taking an order from the Montreal Street Railway Company for six hose bridges, the sale of which will doubtless lead to the placing of quite a number of these exceedingly useful appliances in the Dominion.

THE MISSISSIPPI TELEPHONE COMPANY has established headquarters at 538 Josephine Street, New Orleans, but will continue its office at Hazlehurst, Miss., as a branch. The company, through the energetic methods of its president, Mr. D. L. Rush, has worked up a flourishing business in telephone construction work which is constantly on the increase.

PATENTS IN INDIA.—We have received from the long-established firm of Messrs. Cantwell & Co., patent agents at Calcutta, India, through their representative, Mr. N. Cantwell, at present in New York, their handy little pamphlet, which deals fully with the laws and regulations appertaining to the taking out of patents and registering of trade-marks in India and other Eastern countries. The pamphlet should prove a useful adjunct to the file of patent solicitors in this country.

ONE OF THE HANDIEST APPLIANCES on the market is the "Little Giant" wire reel, a descriptive catalogue of which has just been issued by Hanne Bros., Jacksonville, Fla., who manufacture the device. The reel is adjustable to any desired diameter, from 8 to 26 inches, and fastened securely at any point within this range. Hanne Bros. also make what they call the "Gem" reel, which is very similar to the "Little Giant." The catalogue will be of much interest to supply dealers and construction men.

A BROCHURE IN GREEN has been issued by the Adams-Bagnall-Electric Company, of Cleveland, and is a beautiful piece of work typographically, as well as being an able production argumentatively. The burden of its song is the "A-B" incandescent lamp, which is thoroughly described, the description being effectively illustrated. The claims made by the manufacturers for the lamp are excellent mechanical design, better distribution of light, and freedom from liability to short circuits in the neck of the lamp.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., manufacturer of presses and dies, is building a large double-crank press for cutting armature discs and a special indexing press; also a full set of dies, dials, etc., for notching armature discs for one of the large electrical companies in Wisconsin. The company has recently shipped some large presses for electrical work to the various firms over the country. The shops are running full time, and working evenings with a large force of men, and bringing out from time to time various new presses and attachments for electrical work.

ROTH BROS. & CO., 30 Market Street, Chicago, have issued their third catalogue of dynamos and motors, ranging from 10 to 75 lights, and ⅛ to 7 hp capacity, respectively. These machines are very simple and compact in construction, the field cores being of round wrought iron having the pole-pieces cast around the ends. They are bipolar, of the inverted horse-shoe types, and are provided with self-oiling bearings, non-combustible rheostats and commutators built up of hardened copper, in conformity with the latest practice. The demand for these machines has been most encouraging, and the firm's business is growing in a thoroughly gratifying manner.

CHARLES WIRT, corner Ludlow and Thirty-First Streets, Philadelphia, is distributing copies of a neat catalogue of Wirt brushes, which also contains a great deal of useful information on the care of commutators, selection and handling of brushes, etc. Mr. Wirt very logically states that "commutators are more expensive than brushes," and points out the saving in commutator repairs to be effected by using his patent brush, composed of a section of low resistance leaves between two sections of high resistance leaves and made very flexible, so as to afford ample contact with a minimum pressure. Announcement is made to the effect that Mr. Wirt will himself hereafter manufacture his brushes, the contract having expired under which other parties were licensed to make the device.

"LARGE ARC DYNAMOS," Mr. C. N. Black's paper, read last February at the Cleveland Convention, has been published in pamphlet form by the Brush Electric Company, Cleveland, and makes thoroughly entertaining reading. The pamphlet is liberally illustrated, and the description of Brush dynamos is the most lucid ever published. Large illustrations are given also of the various arc lamps manufactured by the Brush Company, and the automatic regulator which is now furnished with Brush arc dynamos. The regulator is a very compact and interesting device, and works with such a degree of sensitiveness as to allow the full load to be thrown on and off with impunity. The pamphlet is unusually well printed on heavy plate paper, and is a valuable reference book for those operating Brush dynamos or intending to purchase large arc machines.

THE GOULDS MANUFACTURING COMPANY, of Seneca Falls, N. Y., reports the following recent sales of triplex pumps: The Gould Company, Chicago, Ill., one 7 inch by 8 inch, triplex electric power pump, for elevator plant; Holtzer-Cabot Electric Company, Brookline, Mass., one 1¾ inch by 2½ inch, triplex electric pump; Frederic Nell, London, England, one 1¾ inch by 2½ inch, triplex power pump; Lawrence Manufacturing Company, Lawrence, Mass., one 7 inch by eight inch, triplex boiler feed pump; Mine & Skelter Supply Company, Denver, Col., one 7 inch by eight inch, triplex power pump; Westinghouse, Church, Kerr & Co., Boston, Mass., one 3 inch by four inch, triplex power pump; Reuter & Mallory, Baltimore, Md., one 4 inch by 4 inch, triplex boiler feed pump. Besides the above a large number of pumps have been sold for other purposes not connected directly or indirectly with electrical work.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 22, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York City.]

548,176. MAGNETIC ORE SEPARATOR; C. G. Buchanan, Brooklyn, N. Y. App. filed Feb. 13, 1895. The combination of a drum having magnets therein, feeding devices for the ore, an endless carrier belt running over a rear magnetic roll, and guides for the ore next the roll.

548,210. TELEPHONE RECEIVER SUPPORT; I. J. Kusel, St. Louis, Mo. App. filed Feb. 18, 1895. The combination of a rigidly-fixed hook, a spring-actuated plunger passing through the base of the hook, a resilient metallic strip carried by the end of said plunger, contact plates located upon each side of each end of the resilient strip, and with which the conducting wires from the talking and ringing circuits are connected.

548,217. METHOD AND APPARATUS FOR RECTIFYING ALTERNATING-CURRENTS; J. E. Neher, Pittsburg, Pa. App. filed Aug. 7, 1893. A method which consists in rectifying currents and transmitting these rectified fluctuating currents to the translating devices through a choking coil, and thus producing a magnetic field of one direction, whereby reversed currents due to the C. E M. F. of said translating devices are prevented.

548,227, 548,228 and 548,229. TELEPHONE EXCHANGE APPARATUS; C. E. Scribner, Chicago, Ill. App. filed March 5, 1892, Feb. 7, 1893 and Feb. 28, 1895. The combination of a telephone line and an individual annunciator consisting of a main rotating magnet and its armature, a restoring magnet and its armature acting as a drop and normally engaging with the armature lever of the retaining magnet, and when in engagement resting a hort distance from the pole of the restoring magnet, and a key included in the circuit of the retaining magnet, the drop when attracted to its pole being adapted to open the key.

548,230 and 548,231. METHOD OF AND MEANS FOR TEMPERATURE ADJUSTMENT FOR INDUCTANCE COILS; O. B. Shallenberger, Rochester, N. Y. App. filed April 15, 1895. An inductance coil provided with a core having interruptions or air gaps, and an expansion bar for automatically varying the dimensions of such air gaps in accordance with changes in temperature.

548,266. AUTOMATIC SWITCH FOR ELECTRIC TRANSFORMERS; A. G. New, A. J. Mayne and R. N. Lucas, London, England. App. filed June 25, 1894. The combination of a weighted spring-controlled lever operating a main switch, a pair of solenoids with a core in one, adapted to engage with a catch, a spring carried by the second core, a contact arm attached to one end of a pivoted lever, and means for holding the lever against the action of the spring, and releasing same.

548,280. ELECTRIC STOP MECHANISM; W. M. Wood and J. C. Miller, Elmira, N. Y. App. filed June 7, 1894. The combination of a motor mechanism, the machinery to be stopped, and a switch device connected with an electrical generator, trip devices for releasing purposes, a single circuit closer adapted to operate special switches controlling the trip mechanism, whereby to stop the machinery and cut out the source of electrical supply, simultaneously.

548,282. ELECTRO-MECHANICAL LOCK; W. W. Alexander, Kansas City, Mo. App. filed Nov. 15, 1889. The combination of a retarding device consisting of a flat rotary disc, a retarding pawl adapted to engage with its flat face to rotate said device, and a brake adapted to check said rotation.

548,297. CABLE HANGER OR CLIP; W. P. Crockett, Boston, Mass. App. filed May 15, 1895. A clip or hanger consisting of a strap, one end of which is folded over a ring, and a wire device linked through the ring, and provided with one or more hooks at one extremity, and a wedging device at the other end, by means of which, when the band encircles a cable, it is held thereto.

548,317. NON-INTERFERENCE SIGNAL BOX; W. H. Kirnan, Bayonne, N. J. App. filed Dec. 1, 1892. A signal mechanism having a detent, a safety stop consisting of a movable bar having projecting pins, a holding device therefor, and an operating arm.

548,331. MAGNETIC BRAKE; O. S. Walker, Worcester, Mass. App. filed Feb. 20, 1895. The combination of a shell with a surface adapted to fit the periphery of a wheel, a core and an annular chamber contained therein, an electric coil and a binding post also inclosed in the shell, and a pair of collars provided with recesses to receive the wires and insulating washers.

548,371. ELECTRIC LOCOMOTIVE; W. H. Knight, New York, N. Y. App. filed June 15, 1888. The combination of a driven axle of a vehicle, and a propelling electric motor having its yoke end bearing upon the axle, and a connection between the motor and vehicle at an intermediate point between the axles upholding the free end of the motor.

548,383. MAGNETIC SEPARATOR; J. D. McKinnon, Portland, Ore. App. filed April 16, 1895. The combination of a magnetized cylinder, a non-magnetic belt, arranged over the cylinder and passing around rollers on opposite sides of the same, a second non-magnetic belt arranged beneath the first, and a plurality of magnets arranged beneath the second-named belt, so as to exercise its influence on the ore upon the belt.

548,388 and 548,389. THREE-WIRE ELECTRIC RAILWAY; W. B. Potter, Schenectady, N. Y. App. filed July 22 and Aug. 8, 1895. A system consisting of a divided source of E. M. F., a track or ground return forming a negative potential, a neutral conductor at a positive potential, and a positive conductor at a higher number of volts than the other positive potential, but also a positive potential.

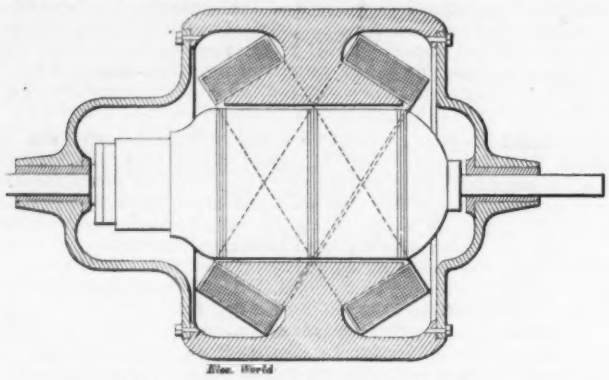
548,396. ELECTRIC CIGAR LIGHTER; F. W. Schindler-Jenny, Kennelbach, Austria-Hungary. App. filed Feb. 19, 1894. The combination of conductors, a heat body containing a glow conductor, and a second heat body containing a resistance conductor in heat giving proximity thereto, the conductors of the heat bodies being in circuit with the other conductors.

548,400. REGULATOR FOR ALTERNATING CURRENTS; C. P. Steinmetz, Schenectady, N. Y. App. filed April 18, 1895. A regulator composed of two stationary cells arranged at an angle to each other, a laminated iron magnetic structure furnishing a path for the lines of force between the coils and a movable magnetic member arranged to vary the path of the lines of force.

548,401 and 548,402. ELECTRIC MOTOR; I. E. Storey, Hornellsville, N. Y. App. filed Jan. 28, 1893. An electric motor having two field magnets and a rotary armature, one of said coils surrounding the other and both coils surrounding the armature.

548,406. DYNAMO-ELECTRIC MACHINE; E. Thomson, Swampscott, Mass. App. filed March 29, 1895. A dynamo-electric machine having a stationary external armature composed of independently removable sections, each section carrying an independent overlapping winding not connected to any other section.

548,413. ELECTRIC ARC LAMP; T. E. Adams, Cleveland, O. App. filed July 8, 1895. The combination of a lamp casing and globe, and telescoping gauze, sections between the globe and the casing.



No. 548,401.—Electric Motor.

548,414. ELECTRIC ARC LAMP; T. E. Adams. App. filed July 10, 1895. The combination of a coarse-wire magnet and a weighted armature for bringing the carbons into contact, and a pair of renewable carbon contacts, one being carried and the other being stationary.

548,415. DRY BATTERY; F. M. Archer, New York, N. Y. App. filed Dec. 15, 1890. The combination of an inclosing case having the removable side and top sections, and a positive element, a porous negative element, and a removable absorbent pad separating said elements.

548,419. ELECTRIC METERING APPARATUS. W. S. Barstow, Brooklyn, N. Y. App. filed April 6, 1895. An apparatus having two independent meter trains, a propelling motor, and a controlling clockwork for throwing the meter train into connection with the motor in alternation.

548,426. RAILWAY SIGNALING. J. P. Coleman, Swissvale, Penn. App. filed May 28, 1895. A double train having two signals at each end, one controlling the normal movement of trains over one track, and the other controlling the reverse movement of trains over the other track, mechanisms for operating the signals at one end being interlocked with the mechanism for operating the reverse signal at the opposite end of the block.

548,435. ELECTRIC BLOCK SIGNALING INSTRUMENT FOR RAILWAYS; A. G. Fraser, Brooklyn, N. Y. App. filed Feb. 26, 1891. A system consisting of a signal controlling part movable to a safety position and a plurality of danger positions, a ratchet and pawl mechanism adapted to restore the part step by step to the safety position, a safety motive device actuating the ratchet and pawl, and a danger motive device acting to disconnect the ratchet and pawl and move the signal controlling part to the extreme danger position.

548,448. CONTROLLER FOR ELECTRIC MOTOR; D. J. M. Lane and G. W. McClintock, Quincy, Mass. App. filed May 2, 1895. The combination of a feed wire terminal, spring-pressed contact members, a pivoted lever having at one end a part arranged to engage said terminal, and a roller upon the opposite end of said lever arranged to engage said contact members.

No. 548,406.—Dynamo-Electric Machine.

548,467. ELECTRIC METER; W. H. Scott, Norwich, Eng. App. filed Nov. 4, 1892. An electricity meter having an electro-dynamometer provided with conductors in series and in shunt, one of the conductors being movable in combination with means for periodically making and breaking the shunt circuit, whereby the moving conductor is made to move periodically an amount in proportion to the watts or amperes multiplied by volts in the circuit.

548,469. AUTOMATIC BLOCK SYSTEM; J. Shoecraft, Harveyville, Mass. App. filed March 27, 1895. An automatic block system provided with a releasing device for the motors, comprising a notched wheel, an armature lever adapted to engage the notches on the said wheel, an arm projecting from the armature lever, and a block having notch guarded by a spring adapted to engage the said arm, the said spring being secured to one of the wheels of the motor.

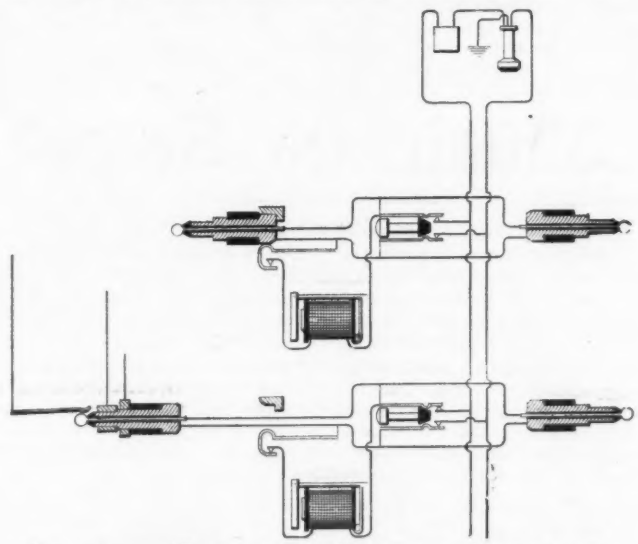
548,481. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; R. Uren, Hancock, Mich. App. filed May 10, 1894. An open insulated conduit partly filled with water or other conducting liquid having a stratum of oil or other non-conducting fluid superimposed thereon, and a conductor located in the conduit and surrounded by the conducting fluid.

548,492. IGNITING DEVICE; W. White, Brunswick, Victoria. App. filed Feb. 5, 1895. The combination of a vessel containing liquid, a gas inlet pipe extending through the said vessel to a point above the liquid, and a gas outlet pipe extending from that point out to the burner, a vertically sliding gas holder immersed in a liquid contained in said chamber and provided at the top with a depending tube, the upper end of which is closed and the lower end open and adapted to project below the surface of the liquid and inclose the upper end of the gas exit pipe when the gas holder is in its lowest position, and electric igniting devices adapted to be actuated from the gas holder when the latter rises.

548,504. COMBINED ELECTRIC AND CABLE RAILWAY; G. E. Beach and M. J. Kern, San Francisco, Cal. App. filed Aug. 1, 1892. The combination of a haulage cable adapted to serve as an auxiliary power for the propulsion of cars, and actuated by an electric motor, a means for driving such motor by electricity, derived from the same source as the supply for the car motor.

548,509. ELECTROMAGNETIC BRAKE; J. L. Black, St Louis, Mo. App. filed May 9, 1894. The combination of a magnet having an unobstructed central opening cores formed in sections moving secured together, and connections between the outer sections of the cores and the brake mechanism.

548,510. Filed April 13, 1895. Substantially the same as above.



No. 548,229.—Keyboard for Telephone Switchboard.

548,511. METHOD OF TRANSFORMING PERIODIC ELECTRIC CURRENTS TO CONSTANT EFFECTIVE POTENTIAL; P. Boucherot, Paris, France. App. filed Dec. 10, 1892. A method consisting in combining in shunt in the circuit in which the current of constant effective intensity is given, an apparatus possessing electrical capacity and one giving the quality of self-induction, whereby the constant difference of potential will be found between the one or other pair of adjacent terminals of these two apparatus.

548,514. UNDERGROUND CONDUIT SYSTEM; H. C. Burk, Cleveland, O. App. filed Feb. 28, 1893. The combination of a line wire, insulating strips pivoted to the sides of the conduit upon arms and insulated therefrom, levers having arms and pivoted between the insulating blocks, and a wheel adapted to pass through the conduit slot and depress the said strips.

548,574, 548,575 and 548,576. PHOSPHORESCENT ELECTRIC LIGHTING BY INTERRUPTIONS; D. Mc F. Moore, New York, N. Y. Apps. filed Jan. 3 and 24, 1895. A system consisting of a source of current, an evacuated inclosure containing conductors connected to the source, and a circuit breaker and maker and a self inductive medium interposed in said circuit.

548,583. ELECTRIC SNAP SWITCH; J. H. McEvoy, Waterbury, Conn. App. filed Feb. 18, 1893. The combination of peripherical contacts and a switch bar, other yielding contact plates having bent arms and attaching plates and means for connecting it to the switch bar.

548,595. AMALGAMATOR; A. C. Rumble, San Francisco, Cal. App. filed Jan. 31, 1895. An amalgamator consisting of a rotary cylinder having a metallic lining formed with a series of broad wings a discharging chamber having a series of peripheral discharges, and an adjustable regulator for controlling the discharge into the chamber.

548,599. ELECTRIC STREET CAR CONTROLLER; G. Valley, Cleveland, O. App. filed Dec. 5, 1894. The combination of a drum and a switch of a controller, a disc being attached to the drum and having notches corresponding to the operative positions of the drum, a notched disc attached to the shaft of the drum, a locking pawl adapted to engage with the end of the disc, and a spring connecting the pawls.